ENCOURAGING BLOOD AND LIVING ORGAN DONATIONS

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Introduction

This thesis analyzes the decision of becoming blood and living organ donors from different perspectives. Theoretical and empirical approaches are provided. The thesis is composed of four papers. The following lines are a synthesis of the objectives and main results obtained for each of the papers. To situate the reader in the context, I start by explaining how is the situation and the problems that I will treat in this thesis. I also give some general explanations on the methodology used for regression analysis (standard probit, Heckman selection probit and panel data models) in the empirical work, for easiness of the reading and interpretation of results.

Summary: The Economics of blood and living organ donations

This thesis is motivated by the fact that only 1% of the world population donates blood while 90% of the population would be capable of donating. This small percentage of blood donors is attributed in part to the lack of information, fears, availability, and other reasons. The waiting lists for organ transplantation do not stop increasing. One of the main reasons for this fact is the successful reduction in traffic fatalities in the last decade as a result of new traffic laws and campaigns to reduce mortality in traffic accidents. In addition, thanks to the health care progresses individuals' life expectancy has increased, thus, the population is ageing. However, the younger generations are not enough to compensate the loss of donors due to aging or health problems. Therefore, in most of the countries the demand for blood and organs for transplantation is higher than its supply. The probability of being recipient of a blood transfusion or an organ increase for individuals as the population is ageing and has more health problems associated with age.

There is an ongoing need of increasing the number of blood and organ donors. Research has been done exploring attitudes towards blood and organ donations in different populations. However, small consensus has been achieved on what leads individuals to become or not donors.

Methods

I. Theoretical Approach

We begin by proposing a decision model, specific for the case of blood and living organ donations, which helps to disentangle the psychology behind such a decision. This model assumes that donation is voluntary and altruistic, and that the decision is only motivated by individuals' degree of altruism and self-interest utilities. For a partly self-interested and partly altruistic individual, the expected utility of becoming a donor is a function of his/her consumption of goods and services, the perceived costs of donation, the pleasure of giving, and the recipient's utility associated with donation. Then, the model is extended to the situation in which incentives are offered for donating blood and living organs, in order to explore the consequences of introducing incentive mechanisms over individuals' behavior and decision making. We show how altruism could be affected by the introduction of incentives and modify individuals' behavior when facing the decision of donating blood and living organs.

II. Empirical Approach

In the first two papers, we explore, through a questionnaire to a university population, the profiles of blood and living organ donors. We start by examining the importance of benefits and costs of blood and living organ donations, as well as other factors related to individuals' information and trust, and control variables for the different groups of blood and living organ donors. Results show there are differences on how the different groups of blood and living organ donors are influenced by the expected per-se and other-regarding benefits of donation, and also by information and trust factors. The questionnaire also includes some questions about incentives. As a proxy for crowding-effects we use the individuals' attitudes towards incentives, attitude being measured by an agreement/disagreement scale. In this paper, the analysis focuses on the probability of the different groups of blood and living organ donors to agree/disagree with each of the incentives.

The third paper analyzes the case of blood donations in France. The objective of this article is to analyze the determinants of blood donation in the French population in age and ability to make this donation distinguishing active donors from potential donors. Data from the Health and Social Protection Survey (ESPS) 2012 are used. We test the hypothesis that altruism, socioeconomic characteristics, and health, are

important determinants of blood donation. Given that the 2012 ESPS survey is the primary source of data in the general population to combine socio-economic, demographic and health characteristics with questions about blood donation.

Finally we explore the impact of new advertising campaigns for blood donation that the blood donors' association of Navarra (ADONA) started implementing in 2010. The aim is to compare these campaigns that ADONA implemented since 2010 with previous ADONA campaigns and other events for encouraging blood donation implemented in the past in the same region. To analyze the impact of pro-donation campaigns we propose three indicators: 1st. the difference in the days between two consecutive donations for each individual, as a measure for variation in the frequency of blood donations when there is a campaign active and where no campaign is active; 2nd. the incremental days between consecutive donations as a measure for variation in regularity on blood donation behavior when there is a campaign active; 3rd. the proportion of new donors with and without campaigns active. Controlling for individuals' characteristics and identifying other events than could be taking place at the same time than the donation campaigns we reduce the estimation bias, and propose a model to better isolate the effect of campaigns.

The probit model

The purpose of the probit model is to estimate the probability that an observation, *i*, with particular characteristics, *x,* will fall into a specific one of the categories, *j*; moreover, if estimated probabilities are greater than 1/2 they are treated as classifying an observation into a predicted category, the probit model is a type of binary classification model. It takes the following form:

$$\Pr[Y_i = j \mid x] = \Phi(x_i \beta)$$

where Pr denotes the probability, and Φ is the Cumulative Distribution Function (CDF) of the standard normal distribution. Thus, the CDF plays the role of transformation function in the case of the probit model. The advantage of using the CDF is that it is easily evaluated numerically and its first derivative is simply the standard normal density function, $\phi(x)$.In our case, our models will be such that the dependent variables of the probit will take only two possible values ($j=\{0, 1\}$). The parameters β are typically estimated by the method of Maximum Likelihood. Because

the dependent variable is discrete, the likelihood function cannot be defined as a joint density function such as in the case of models with a continuously distributed dependent variable. The likelihood function should be defined as the probability that the value j is realized, rather than as the probability density at that value. With this redefinition for the particular case of discrete dependent variables, the sum of the possible values of the likelihood is equal to 1. So we have sums instead of integrals when the dependent variable is continuous. The log-likelihood function is:

$$l = \sum_{i=1}^{N} \left(y_i \ln \Phi\left(x_i \beta\right)\right) + (1 - y_i) \ln\left(1 - \Phi\left(x_i \beta\right)\right)$$

For each observation, one of the terms inside the large parethesis is always 0 and the other is always negative. The first term is 0 whenever $y_i=0$, and the second term is negative because it is equal to the logarithm of a probability, and the probability by definition is in the interval [0, 1].

Maximizing the Maximum likelihood function (applying first order conditions) reports the estimates for the coefficients $\hat{\beta}$, which will be consistent, asymptotically normal, and efficient, provided that E(XX') exists and is not singular. The result of a probit model is the computation of the probability of occurrence of an event (Y=1) in a population, conditioned to a set of individual's characteristics of that population. The probability of $Y_i=1$ conditional to some characteristics of the population X can be computed as follows:

$$\Pr[Y_i = 1 \mid X] = 1 - \exp\{-\exp(x_i \beta)\}$$

Once the parameter estimates are obtained and also the probabilities of the events can be computed, a natural step is to consider the marginal effects of the covariates in the conditional distributions.

Let β be the vector of k regression coefficients in the current model fit, let x be a vector of covariate values, and let $\Phi\left(x, \hat{\beta}\right)$ be the scalar valued function (CDF for probit) returning the value of the predictions of interest.

The marginal probability effect of a binary variable x_k is a function $h\left(x, \hat{\beta}\right)$ that is expressed and interpreted as follows:

$$h\left(x_k, \hat{\beta}\right) = \Phi\left(x_{1i} \hat{\beta}\right) - \Phi\left(x_{0i} \hat{\beta}\right)$$

For $x_{,ij}$ the vector of j regressors included in the model, the marginal probability effect of a binary explanatory variable equals: the value of $\Phi\left(x, \hat{\beta}\right)$ when x_{ij} =1 and the

other regressors equal fixed values, minus the value of $\Phi(x, \hat{\beta})$ when x_{ij} = 0 and the other regressors equal the same fixed values.

For the case of a binary variable x_k, this would be the same than saying that the marginal effect is the probability of $y_i = 1$ conditional to the values of the k-1 covariates given that the value for covariate x_k is 1, minus the same probability when the value for covariate x_k is 0.

$$h(x_k, \hat{\beta}) = \Pr(y_i = 1 \mid x, x_k = 1) - \Pr(y_i = 1 \mid x, x_k = 0)$$

The probit model with sample selection

The probit model with sample selection (Van de Ven and Van Pragg 1981) assumes that there is an underlying relationship such that:

$$Y^*_i = X_i \cdot \beta + \varepsilon_{1i} \quad (1)$$

Where (2) is the latent equation so that the outcome Y^* is not always observed. Instead, the dependent variable for observation "i" is observed if:

$$Y_i = Z_i \cdot \gamma + \varepsilon_{2i} > 0 \quad (2)$$

Where (2) is the selection equation. The Heckman selection model assumes that the errors of the latent and selection equations follow a normal distribution such that $u_1 \sim N(0, 1)$ and $u_2 \sim N(0, 1)$, but also that there is a positive correlation between the two error terms, such that $corr(u_1, u_2) = \rho$. If the hypothesis of null correlation between the errors is rejected ($\rho \neq 0$), estimation using a standard probit will lead to biased results.

In this case, the Maximum Likelihood function is:

$$\ln L = \begin{cases} w_i \ln \Phi\left(\dfrac{z_i\gamma + (y_i - x_i\beta)\cdot \rho/\sigma}{\sqrt{1-\rho^2}} - \dfrac{w_i}{2}\left(\dfrac{y_i - x_i\beta}{\sigma}\right)^2 - w_i \ln\left(\sqrt{2\pi}\sigma\right)\right), & y_i \text{ observed} \\ w_i \ln \Phi(-z_i\gamma) \quad , & y_j \text{ not observed} \end{cases}$$

Where Φ is the standard cumulative normal and w_i the optional weight for observation i. In the MLE σ and ρ are not directly estimated, but we can directly estimate instead ln σ and atanh ρ, where

$$a\tanh\rho = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right)$$

The standard error of λ= σ ρ is approximated through the proportion of error (delta) method.

$$Var\ (\lambda) \approx \mathrm{D}\ var\{atanh\ \rho * ln\ \sigma\}\mathrm{D}'$$

Where D is the jacobian of λ with respect to atanh ρ and ln σ.

The two-step estimates are computed using Heckman's procedure. Probit estimates of the selection equation are obtained as:

$$\Pr[Y_i = observed \mid Z_i] = \Phi(x_i\gamma)$$

The obtention of marginal effects having the estimates for the parameters of the model is the same than we explained for the probit model. We focus then on explaining the selection problem and when estimating a Heckman selection model would be preferred to a standard probit.

From these estimates, the nonselection hazard –what Heckman referred to as the Inverse Mills Ratio, m_i – for each observation i, is computed as:

$$m_i = \frac{\phi(z_i\hat{\gamma})}{\Phi(z_i\hat{\gamma})}$$

We also define for the Heckman model:

$$\delta_i = m_i\,(m_i + \gamma z_i)$$

Following Heckman, the two-step parameter estimates of β are obtained by including the non-selection hazard term (m_i) in the regression equation and running the estimation. Thus, the regressors become [X m], and we obtain the additional parameter estimate β_m on the variable containing the non-selection hazard.

A consistent estimate of the regression disturbance variance is obtained using the residuals from the augmented regression.

The two-step estimate of ρ is then: $\hat{\rho} = \frac{\hat{\beta}_m}{\hat{\sigma}}$ where $\hat{\sigma} = \sqrt{\frac{e'e + \beta_m{}^2 \sum_{i=1}^{N} \delta_i}{N}}$

Heckman derived consistent estimates of the coefficient covariance matrix on the basis of the augmented regression.

Let W = [X m] and R be a square diagonal matrix of dimension N with (1- $\hat{\rho}^2 \delta_i$) as the diagonal elements. The conventional variance-covariance estimate is:

$$V_{TWO\text{-}STEP} = \hat{\sigma}^2 (W'W)^{-1}(W'RW + Q)(W'W)^{-1}$$

Where:

$$Q = \hat{\rho}^2 (W'DZ) V_p (Z'DW)$$

Where D is the diagonal matrix of dimension N with δ_i as the diagonal elements; Z is the data matrix of selection equation covariates; and V_p is the variance-covariance

estimate from the probit estimation of the selection equation.

The probit Heckman selection provides consistent estimates in the presence of positive correlation between the errors of the regression and selection equations, asymptotically efficient for all parameters of the model. For the model to be well identified, the selection equation must have at least one variable that is not in the equation of the standard probit model. Otherwise, the model would be identified only by the functional form, and the coefficients will not have the correct structural interpretation.

The Heckman selection model depends strongly on the model being correctly, much more than ordinary regression. Running a separate probit for sample inclusion and followed this first step by a regression (the two-step model) is an especially attracted alternative if the regression part of the model arose because of taking a logarithm of zero values. However, when the model is not properly specified or if a specific dataset simply does not support the model's assumptions, the standard Heckman model may not be stable. The two-step Heckman selection model is generally more stable when the data are problematic (i.e exploring a large dataset), and this is the reason why we will use the two-step Heckman selection model in the third article of this thesis, in which data from a survey to the population of France are analyzed.

Panel Data Models

A longitudinal or panel dataset is one that follows a given sample of units (we will use individuals, but could be regions, countries, or any kind of physical units in general) over time, and thus provides multiple observations on each individual in the sample. Using panel data sets for economic research has many advantages with respect to cross-sectional or time-series data. A panel usually gives the researcher a large number of observations, increases the degrees of freedom and reduces the collinearity among explanatory variables. So estimation using a panel data improves the efficiency of the econometric estimates. In addition, longitudinal data allow a researcher to analyze important economic questions that with other type of data sets would simply not be possible to analyze. In our specific case, we use panel data analysis in the last paper of this thesis to follow blood donors along time. Having a longitudinal data set allows us to estimate the impact of campaigns looking at behavioral changes in the population of blood donors when campaigns are active and when they are not active.

Consider fitting models on the form:

$$y_{i,t} = \alpha + x_{i,t}\beta_1 + s_i\beta_2 + z_t\beta_3 + \nu_i + \varepsilon_{i,t}$$

Where subscript $i=\{1,...N\}$ and $t=\{1,...,T\}$ refers to the level of observation of units (i.e individuals, regions, countries,…) and time (i.e days, weeks, months, years,…) respectively. $x_{i,t}$ is a set of covariates that change with units and time, s_i is a variable that changes with units but is time-invariant (such as sex or race) and z_t is a variable which changes with time, such as age. Failure to include heterogeneity quantities in the model may introduce serious bias into the model estimators, important variables having been omitted from the model.

The residual that we have little interest in is the sum of $\nu_i + \varepsilon_{i,t}$, that is the error due to omitted variables that change with time or with individuals and time at the same time. We are interested in the estimation of β_1, β_2 and β_3.

A longitudinal data design may yield more efficient estimators than other designs, such as cross-section or time-series. For example, suppose that the interest is assessing the change in a particular outcome *y* over time: that is $y_{\bullet 1} - y_{\bullet 2}$ is the difference between the outcome in two time periods, 1 and 2, for the individual *i*. In a repeated cross-section analysis we would calculate the reliability of this statistic assuming independence among cross-sections to get: $\text{var}(y_{\bullet 1} - y_{\bullet 2}) = \text{var}(y_{\bullet 1}) + \text{var}(y_{\bullet 2})$

However, in a panel data set, the assumption of Independence between cross-sections cannot be accepted, and in general we have to asume that cov($y_{\bullet 1}, y_{\bullet 2}$)>0, and therefore the following expression demonstrates that the variance is smaller than in a cross-sectional data set (if and only if the covariance term is positive).

$$\text{var}(y_{\bullet 1} - y_{\bullet 2}) = \text{var}(y_{\bullet 1}) + \text{var}(y_{\bullet 2}) - 2\,\text{cov}(y_{\bullet 1}, y_{\bullet 2})$$

For estimation of the impact of blood donation campaigns on the behavior of the blood donors in a given population, we use the Random Effects model. We chose to estimate the model using randon effects because the primary variables of interest, in our case the dummy variables representing the campaigns being actives, are time constant, and therefore in this cases it is suggested to use the random effects model.

Estimating with random effects implies estimating the model by Generalized Least Squares (GLS). This means that the variance-covariance matrix of the OLS method is transformed in order to achieve efficiency in the estimation. The calculation of the GLS estimator assumes that the variance components σ_ν^2 and σ_ε^2 are known.

1

Attitudes towards altruistic blood and living organ donations

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Abstract

This paper models the decision of whether to become a blood/living organ donor and empirically analyses the factors influencing this decision. For a partly self-interested and partly altruistic individual, the expected utility of becoming a donor is a function of his/her consumption of goods and services, the perceived costs of donation, the pleasure of giving, and the recipient's utility associated with donation. The empirical analysis examines, for the different groups of blood and living organ donors, the influence of the expected benefits and costs of donation, factors related to individuals' information and trust, and control variables. Results show there are differences on how the different groups of blood and living organ donors are influenced by the expected per-se and other-regarding benefits of donation, and also by information and trust factors. We conclude that policies to increase the number of donors should address the issues of encouraging altruism, reducing the perceived costs of donation, increasing the level of trust in the Health Care System, and providing more information.

Key words: Altruism; Uncertainty; Decision making; Blood Donations; Living Organ Donations

JEL classification: D6, D8, D9, I1

1. Introduction

Blood donations in certain countries seem to have peaked donations due to the ageing of the donor population (Ditto *et al*., 2003; Greinacher, Fendrich, and Hoffmann, 2010) and difficulties in replacing lost donors. As blood cannot be manufactured artificially, maintaining the donor population is critical.

Meanwhile, organ donations from deceased donors are also decreasing due to a reduction in traffic fatalities (Dickert-Conlin, Elder and Moore, 2011; Stuckler et al., 2011; de Lago, 2011), and as a result the number of people on waiting lists for organ transplantation is increasing exponentially (Becker and Elías, 2007). Despite the recent changes in the definition of death for cadaveric donation of organs and presumed consent legislation (Abadie, Gay, 2006), the shortage of organs for transplantation remains high. These circumstances have resulted in growing interest in encouraging living organ donations, as an alternative method to fill the gap between supply and demand for organs.

Important research has examined kidney exchange among living donors, generating chains of donors using a model based on compatibility criteria proposing methods to increase living organ donations (Roth, Sönmez, Unver 2004 and 2005), or experimental studies in the laboratory for the evaluation of hypothetical organ allocation policies and their impact on donor registration (Kessler and Roth, 2012). However, much work remains to be done. During the period 2005-2010, the shares of kidney and liver transplants from living donors in European countries remained stable at 3% and 18%, respectively. In 2012 the Newsletter Transplant Report registered more than 45,000 patients waiting for a kidney and approximately 20,000 for a liver, and the death rate among these individuals is high. Thus there is an urgent need to encourage donations and increase the supply of blood and organs (Epstein, 2008).

The donation of blood and organs can be understood as a form of pro-social or altruistic behaviour. Adopting the classical definition of altruism given by Auguste Comte, “self-sacrifice for the benefit of others”, and the concept of impure altruism developed by Andreoni (1990), we develop a model where donors can be considered partly altruistic individuals. Individuals who decide to become donors are, in our model, willing to make a personal sacrifice to improve the well-being of another individual or even society as a whole, provided that they do not expect a loss of total

utility (relative to the utility of not donating) by doing so.

Impure altruism has been understood through the economics of giving (Culyer, 1971 and 1980; Kolm, 2006; Clotfelter, 2002) as a way of behaviour when donating not only blood or organs but also for the general context of charitable giving. First, individuals consistently expect an impact on utility, either positive or negative, due to the variables associated with donations that define his/her self-interest (as opposed to the interests of others). However, individuals may also expect some social benefits from giving to others. These benefits can be derived from the mere fact of giving, irrespective of the success or failure of donation for the recipients, deriving a benefit due to the pride of being considered a good person by other individuals the rest of individuals – the warm glow (Andreoni, 1990) –, but also for the empathy or concern for another individual or group of individuals (individuals may have other-regarding preferences), some individuals being concerned about the improvement in the well-being of the recipient/s. Improvements are measured as the incremental utility as a result of donation, only if the result is a health improvement for the recipient.

Behind these arguments are multiple variables that individuals consider important for their decision to donate blood and living organs according to the literature. Researchers agree, for example, on the influence of a sense of duty (Wildman and Hollingsworth, 2009), responsibility, and love, as well as various psychological rewards (Thorne, 2006). Other influential variables that have been explored in the context of blood and living organ donations include trust in the health-care system (Rando, Blanca and Frutos, 2002), solidarity, family tradition (Goette and Stutzer, 2008), and reciprocity (Fehr and Schmidt, 2006; Fong, Bowles and Gintis, 2004).

Lots of empirical works have been done to find the motivations for donating blood and organs in different populations. However, the literature on attitudes towards donation lacks of a theoretical model that represents the specific decision to donate blood or living organs. Thus, our aim in this paper is to provide a behavioral model, to represent the individuals' decision of whether to become or a blood/living organ donor.

We propose a specific and parsimonious model of behavior –assuming linearity between self-interested and other-regarding preferences– for the decision of whether to become a blood or a living organ donor. The model assumes that the utility from donating blood or organs in life is a function of the expected benefits and costs of donation, these benefits and costs being different for each type of donation. We

suggest that differences between individuals in their attitudes towards donation are based on expectations of the benefits and costs of donation. The model is specific to this type of in-kind giving and is applicable to both types of donations considered – blood and living organs– although specificities of each are considered.

Empirically, we analyze the differences between different groups of donors through a questionnaire on attitudes towards blood and living organ donations in a selected population. We check for the influence of the expected benefits and costs of donating blood or living organs, and also other relevant variables that could be of influence for individuals' decision, such as information and trust factors or the importance of having predecessors.

The paper is organized as follows. In Section 2, the standard economic approach of a utility-maximizing rational individual is considered. Section 3 presents the empirical work. The empirical analysis focuses on explaining the differences between groups of donors according to control variables (gender, age and education), the expected costs and benefits of donating blood or living organs, and other factors that could influence the decision of becoming or not a donor related to information and trust in the Health Care System. The methods and results of the empirical analysis are presented in section 4. Section 5 discusses the most significant findings of the paper and proposes questions for further research. Finally, section 6 concludes.

2. The Model

2.1 The decision of becoming or not a donor

An individual *i* faces the decision of whether to become a blood/living organ donor. The individual's preferences are represented by a utility function that fulfils all of the conditions for numerical representation (asymmetry, negative transitivity and continuity) and is additively separable into self-interested and altruistic utilities (Becker and Barro, 1986; Levine, 1998).

Preferences for any individual *i* are represented by a utility function U_i, that is a mapping U_i: $\Re^4 \rightarrow \Re$ such that:

$$U_i = U_i\left(X_i, C_i, G_i, U_{-i}\right) \quad \textbf{(1)}$$

where X_i is a finite set of goods and services available for consumption by the ***i***-th individual, C_i represents the function of expected costs from donating, G_i represents the expected benefit from donating *per-se* (the warm-glow), and U_{-i} the utility associated with the donation experienced by recipient -*i*.

Preferences are assumed to be monotonic in X_i, in G_i, and U_{-i}, but not in C_i, and the marginal effects are expected to be:

$$\frac{\partial U_i(.)}{\partial X_i} \geq 0; \frac{\partial U_i(.)}{\partial C_i} \leq 0; \frac{\partial U_i(.)}{\partial G_i} \geq 0; \frac{\partial U_i(.)}{\partial U_{-i}(.)} \geq 0 \quad \textbf{(2)}$$

That is, the utility of the individual *i* increases in consumption (X_i), the expected benefit associated with donation *per-se* (G_i), and the expected gain in utility for the recipient (U_{-i}), and decreases in the expected costs of donation (C_i).

We assume linearity and additive separability: the self-interested and altruistic components of utility are independent, such that the weights an individual assigns to them are complementary. However, each function (we will use π_i for the function representing self-interest and v_i for the function representing altruism) is additive in its arguments. Self-interest is a function of own consumption of a set of goods and the expected costs of donation. The additive assumption implies that changes in one of the arguments do not affect the other, but directly affect to the final utility. The same assumption is made for altruistic preferences, which are a function of the very pleasure of donating (the warm-glow or *per-se* benefit) and the expected benefits that the recipient would derive from the donation (the *other-regarding* benefit).

The individual decides whether to become a donor at any point in time during his/her lifetime, considering $t = a,..., a + L_i$ as the finite time horizon for any individual, where L_i represents the life expectancy of an individual of age *a*. Therefore, the decision at time *t* depends on expectations regarding total future utility. Utility is discounted at a rate *r*. For simplicity in the algebra, the discount rates for the donor and the recipient are considered to be the same.

Therefore, the decision of becoming or not a donor for any individual *i* at time *t* is represented by the following function:

$$U_{i,t}(X_i, C_i, G_i, U_{-i}) = \delta_{i,t} \cdot \pi_{i,t}(X_{i,t}, C_{i,t}) + (1-\delta_{i,t}) \cdot v_{i,t}(G_{i,t}, U_{-i,t}(q_{-i,t}, H_{-i,t})) \quad \textbf{(3)}$$

Where: $\delta_{i,t}$ and $(1-\delta_{i,t})$ represent the degree of self-interest and the degree of altruism, respectively, of individual *i*. The parameter $\delta_{i,t}$ can take any value in the (0,1) interval,

such that the individual is defined on a continuum from very self-interested to very altruistic, excluding the possibility of pure selfishness and pure altruism. We assume that an individual's degree of altruism can change over time. π_i and $\nu_{i,t}$ represent the self-interested **(4)** and altruistic **(5)** components of the utility function, respectively, of individual ***i*** at time ***t***, according to the assumption of additive separability:

$$\pi_{i,t}\left(X_{i,t},C_{i,t}\right)=\pi_{i,t}\left(X_{i,t}\right)-\pi_{i,t}\left(C_{i,t}\right) \qquad \textbf{(4)}$$

$$\nu_{i,t}\left(G_{i,t},U_{-i,t}(q_{-it},H_{-i,t})\right)=\nu_{i,t}\left(G_{i,t}\right)+\nu_{i,t}\left(U_{-i,t}(q_{-i,t},H_{-i,t})\right) \qquad \textbf{(5)}$$

Where $\pi_{i,t}\left(X_{i,t}\right)$ is the utility that individual *i* derives from the consumption of a set of *n* goods X_i. At time *t*, each of the goods/services is associated with a different utility. Let the set of utilities be $x_{i,t} = \{x_{1,t}, x_{2,t}..., x_{n,t}\}_i$ and the function representing the utility from consumption associated with donation $\pi(X_{i,t})$. It is assumed that an individual's expected utility of consumption derived from deciding to become a donor may be different from the expected utility of consumption derived from deciding not to become a donor, $\pi(X^0{}_{i,t})$, where $X^0{}_{i,t}$ represents the set of goods available for consumption when an individual decides not to become a donor. Throughout his/her lifetime, $\pi(X_{i,t})$ is considered the discounted sum of the expected utility of consumption at each time period over the whole time frame:

$$\pi_{i,t}\left(X_{i,t}\right)=\sum_{t=a}^{a+L_i}\frac{x_{i,t}}{(1+r)^{t-a}}\geq 0 \qquad \textbf{(6)}$$

$\pi_{i,t}(Ci_{,t})$ represents the disutility derived from the expected losses associated with donation. In general, $C_{i,t}$ represents all of the costs that an individual associates with donation, with $c_{it} = \{c_{1t}, c_{2t}, ..., c_{nt}\}_i$ representing the set of disutilties that an individual expects if deciding to donate at time *t* over the utility at any time greater or equal than *t*. The disutility over the whole time-frame can be expressed as:

$$\pi_{i,t}\left(C_{i,t}\right)=\sum_{t=a}^{a+L_i}\frac{c_{i,t}}{(1+r)^{t-a}}\geq 0 \qquad \textbf{(7)}$$

$\nu_{i,t}\left(G_{i,t}\right)$ represents the individual's expected utility derived from the mere fact of donating at time *t* (the *per-se* utility). The main difference between this term and the warm-glow effect is that the *per-se* benefit is irrespective from the social perception of the individual who donates as a good person. The *per-se* benefit is assumed to be non-negative and is expressed as follows:

$$v_{i,t}\left(G_{i,t}\right)=\frac{G_{i,t}}{\left(1+r\right)^{t-a}}\geq 0 \qquad \textbf{(8)}$$

$v_{i,t}\left(U_{-i,t}\left(q_{-i,t},H_{-i,t}\right)\right)$ represents the utility that individual *i* obtains when the recipient derives positive utility as a result of donation. It not only depends on the expected increases in the recipient's well-being due to the donation, $H_{-i,t}$, but also on the probability of success of the donation, $q_{-i,t}$.

The expected value of the donation for the recipient is the total utility over time multiplied by the probability of the donation's success. It is assumed that this utility is only positive when the donation is expected to be successful, $q_{-i,t} \in (0, 1]$ and the recipient's well-being improves with donation, $h_{-i,t} > 0$. On the contrary, when the probability of success is null, then $U_{-i,t}\ (q_{i,t}=0)=0$. The expression for the other-regarding preferences depends on the expected utility of the recipient, as follows:

$$U_{-i,t}=\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{\left(1+r\right)^{t-a}}\geq 0 \quad \text{э} \quad v_{i,t}\left(U_{-i,t}\left(q_{-i,t},H_{-i,t}\right)\right)=\left(\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{\left(1+r\right)^{t-a}}\right)^{\alpha_{i,t}}\geq 0 \quad \textbf{(9)}$$

where the utility of the donor derived from the utility of the recipient **(9)** will be higher or lower depending on the sensitivity of the donor to variations in the utility of the recipient, measured by a parameter $\alpha_{i,t}$. This term represents the elasticity of individual *i* to the recipient's expected utility from donation. This elasticity will be more relevant in the organ donation case. Thus, for organ donations, it is assumed that an individual, who is impurely altruistic, will not assign more importance to the utility of the recipient than to his/her own utility, and thus $\alpha_{i,t}$ will never be greater than 1 ($\alpha_{i,t}\leq 1$). This means that an increase in the recipient's utility results in diminishing (or proportional) increases in the utility of individual *i*. For the specific case of blood donations, we assume proportionality, and therefore state that $\alpha_{i,t}=1$.

By linking equations 3 to 9, we arrive at the following expression for the expected utility of becoming a blood or a living organ donor (10):

$$U_{i,t}(.)=\delta_{i,t}\cdot\left(\sum_{t=a}^{a+L_i}\frac{x_{i,t}-c_{i,t}}{\left(1+r\right)^{t-a}}\right)+\left(1-\delta_{i,t}\right)\cdot\left(\frac{G_{i,t}}{\left(1+r\right)^{t-a}}+\left(\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{\left(1+r\right)^{t-a}}\right)^{\alpha_{i,t}}\right) \quad \textbf{(10)}$$

The individual, who is *a priori* neither purely self-interested nor purely altruistic, decides whether to become a donor depending on the expected gains and losses associated with the donation. Being a rational individual, he/she decides to become a donor when the expected utility of deciding to become a donor is higher than the

expected utility of deciding not to become a donor. The utility of deciding not to become a donor ($U^0_{i,t}$) is simplified as the expected utility from own consumption of goods and services:

$$U_{i,t}(.)=\delta_{i,t}\cdot\left(\sum_{t=a}^{a+L_i}\frac{x_{i,t}-c_{i,t}}{(1+r)^{t-a}}\right)+(1-\delta_{i,t})\cdot\left(\frac{G_{i,t}}{(1+r)^{t-a}}+\left(\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{(1+r)^{t-a}}\right)^{\alpha_{i,t}}\right)>U^0_{i,t}=\delta_{i,t}\cdot\left(\sum_{t=a}^{a+L_i}\frac{x^0{}_{i,t}}{(1+r)^{t-a}}\right) \quad \textbf{(11)}$$

From this expression, two solutions to the individual's utility maximisation problem emerge. The individual decides to become a donor if $U_{i,t}>U^0{}_{i,t}$. Therefore there are two main possible scenarios in which the individual would decide to become a donor at time *t*, depending on value of the self-interested utility:

$$U_{i,t}-U_{i,t}{}^0>0\Leftrightarrow\forall\sum_{t=a}^{a+L_i}\frac{x^*_{i,t}-c_{i,t}}{(1+r)^{t-a}}>0\quad,\quad\frac{\delta_{i,t}}{(1-\delta_{i,t})}>-\frac{\left(\frac{G_{i,t}}{(1+r)^{t-a}}+\left(\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{(1+r)^{t-a}}\right)^{\alpha_{i,t}}\right)}{\left(\sum_{t=a}^{a+L_i}\frac{x^*_{i,t}-c_{i,t}}{(1+r)^{t-a}}\right)}\qquad\forall x^*_{it}=x_{it}-x^0{}_{it} \quad \textbf{(12)}$$

$$U_{i,t}-U_{i,t}{}^0>0\Leftrightarrow\forall\sum_{t=a}^{a+L_i}\frac{x^*_{i,t}-c_{i,t}}{(1+r)^{t-a}}<0\quad,\quad\frac{\delta_{i,t}}{(1-\delta_{i,t})}<-\frac{\left(\frac{G_{i,t}}{(1+r)^{t-a}}+\left(\sum_{t=a}^{a+L_{-i}}\frac{q_{-i,t}\cdot h_{-i,t}}{(1+r)^{t-a}}\right)^{\alpha_{i,t}}\right)}{\left(\sum_{t=a}^{a+L_i}\frac{x^*_{i,t}-c_{i,t}}{(1+r)^{t-a}}\right)}\qquad\forall x^*_{it}=x_{it}-x^0{}_{it} \quad \textbf{(13)}$$

Equation **(12)** represents the necessary condition for the individual to decide to become a donor for positive expected values of self-interested utility (that is, when costs are sufficiently low). Equation **(13)** represents the condition under which an individual decides to become a donor even for negative expected values of self-interested utility. A peculiarity of the second solution **(13)** is that an individual decides to become a donor and sacrifice his/her self-interested utility if and only if the gains in terms of indirect utility, such as *per-se* and other-regarding benefits, are sufficiently high to compensate for the disutility of the costs of donation.

Deciding to become a blood donor or a living organ donor has very different implications. The expected costs may be higher in the case of facing the decision to become a living organ donor, but the expected benefits may also differ in the two cases.

Let us assume that $c_{i,t}{}^{LOD} > c_{i,t}{}^{BD}$, where LOD refers to Living Organ Donation and BD to Blood Donation. The rest of variables are equal for both donations, two propositions arise (note that analogous propositions to proposition 1 could be developed by holding the costs equal for both types of donations and considering benefits as the comparison variable):

Proposition 1: If the expected costs of becoming a living organ donor ($c_{i,t}^{LOD}$) are strictly higher than the expected cost of becoming a blood donor ($c_{i,t}^{BD}$), provided equal expected benefits from both types of donations, the degree of altruism for individuals who decide to become living organ donors must be higher than the degree of altruism for individuals who decide to become blood donors.

Proof of proposition 1: If $c_{i,t}^{LOD} > c_{i,t}^{BD}$, this implies that, for equal values of expected benefits from both types of donations, the value of the self-interested utility from a living organ donation is lower than the value of the self-interested utility from a blood donation. Mathematically, from the model solutions **(12)** or **(13)**, this is $\left(\sum_{t=a}^{a+L_i} \frac{x^*_{i,t} - c_{i,t}}{(1+r)^{t-a}} \right)^{BD} > \left(\sum_{t=a}^{a+L_i} \frac{x^*_{i,t} - c_{i,t}}{(1+r)^{t-a}} \right)^{LOD}$.

As solutions **(12)** and **(13)** show, the ratio of relative altruism optimal for becoming a donor, $\frac{\delta_{i,t}}{(1-\delta_{i,t})}$, is calculated as the ratio between the expected benefits (nominator) and costs (denominator). If the expected costs are higher and the expected benefits are equal in both donations, the degree of self-interest must be lower when an individual decides to become a living organ donor. Under the assumption of self-interest and altruism being complementary, a lower degree of self-interest implies a higher degree of altruism. Then, we have demonstrated that under the proposed hypotheses, higher expected costs of LOD imply that the degree of altruism necessary for an individual to decide to become a living organ donor must be higher than that for the decision to become a blood donor. □

Proposition 2: When expected self-interested utility is negative, irrespective of the type of donation, the degree of altruism necessary for an individual to decide to become a donor is higher than when the expected self-interested utility is positive.

Proof of Proposition 2: If the individual has decided to become a living organ donor knowing that the expected value for the self-interested utility is negative (solution 2, equation 13), the degree of altruism necessary to become a donor must be higher than when the expected self-interested utility is positive. Otherwise, utility would be negative, and the decision would be to not become a donor. □

2.2 Heterogeneity in donors' behavior

We have proposed a utility function that represents the decision of becoming or not a donor. Blood donation can be performed more than once in life, while a kidney or a liver can be donated only once in life. In both, blood and living organ donations, individuals should be classified into different groups according to their decision and final behavior.

An individual who has decided to donate blood may go once and not donate in the end (being refused for health reasons) or donate once and never donate anymore (having a bad experience or just for a strong change in life that suddenly happened); he/she can go for the first time and become a regular donor after a certain number of donations; he/she may donate blood not regularly, but only in reaction of a blood donation campaign for example. These examples illustrate the different types of blood donors that emerge from the same decision, which was becoming a donor.

We can therefore say that blood donors can be classified into: Regular Donors, Non-Regular Donors, Past Donors (stopped donating whatever the reason), and Refused Donors (went to the transfusion center but was refused to be donor for age or health reasons).

An individual who has decided not to donate blood may be due to a health reason, such that he/she would never be accepted as a blood donor, or he/she has no health problems to become a donor. There are two possible groups among the non-donors: The Refused for health reasons, and the Potential donors, who are perfectly healthy for being a blood donor but who have never thought about donating before, or who have never donated for other reasons different than health problems. The case of living organ donations is similar. An individual who decides donating a kidney or a liver to a relative may be accepted or rejected as a donor.

In the following section we present a questionnaire which aims to explore the differences between groups of blood donors and also between individuals according to the willingness to donate a living organ to a relative.

3. Empirical work

3.1 Methods: A questionnaire on blood and living organ donations

A questionnaire was designed and delivered to the staff of the Public University of Navarre, Pamplona, Spain, and to a list of blood donors from the same region in May 2010. Two different modalities of the questionnaire were delivered: an online questionnaire for the university population, and a paper version of the same questionnaire adapted for the population of blood donors contacted by the regional blood donors' association (ADONA). The questionnaire for the university staff was e-mailed to all potential respondents, 1414 employees at the Public University of Navarre (932 teaching staff and 482 other staff), and reminders were sent after 1 week, 2 weeks and 1 month. To increase the proportion of blood donors in our sample, the questionnaire was also sent by post to a population of 500 blood donors, once and without reminders. Our margin of error is less than 5%, yielding a 95% confidence level, which is considered acceptable for survey research (Bartlett, Kotrlick and Higgins, 2001).

The questionnaire addresses blood and living organ donations separately. It is based in other questionnaires and published studies. We consider the most significant reasons for donating and expected effects referred to by Titmuss (1970), Andreoni (2006), Goette and Stutzer (2008), and Fehr and Schmidt (2006), in the case of blood donations, and Rosel et al. (1995), Rando et al. (1995, 2005 and 2007), Hilhorst M. (2004) and Morgan S. et al. (2008), in the case of organ donations. The questions referring to blood donation are different for Blood Donors and Non-Blood Donors. Concerning living organ donations, the questions are identical for all respondents. Blood donors were asked questions regarding their decision to become donors, and Non-Blood donors were asked about their reasons for not becoming donors. To determine how the perceptions of benefits and costs differ between groups, all respondents were asked to express their perceptions of the benefits and costs of donating blood and living organs. The questionnaire concluded with socio-demographic questions related to gender, age and level of education.

Information concerning the reasons for and against donating and the expected effects of donation may be helpful for a better understanding of individual decision making in the context of blood and living organ donations; it could also help to identify neglected issues entailed by each type of donation—areas where more intervention is needed—and thus orient the design of policies to better attract potential donors.

3.2 Description of the Sample: Classification of Donors and dependent variables

The questionnaire allows distinguishing five groups of blood donors according to their response to the following questions:

1. "*Are you a blood* donor*/have you ever donated blood?*" The possible answers to that question are: *No, I have never donated my blood / Yes, I donate my blood regularly / Yes, I donate my blood, but not regularly / Yes, I have donated my blood in the past, but I stopped / Does not Answer.*

2. We need to distinguish those individuals who do not donate blood because they cannot do it due to health reasons from those who do not donate for a reason which is not health. To this end, we ask individuals about their reasons for not donating blood. Only the non-blood donors answered to this question, and the list of reason was the following: Does not trust the Health Care System, Fear, Has never thought about it, There is no reward or compensation for the donor, Lack of awareness concerning the needs for blood, Other people donate, Health Reasons, and Other reasons (open question).

We observe that among our respondents (N=654), the 44.65% has never donated blood, while the other 55.45% has donated at least once in life, 8.56% has stopped donating, 10.55% donates blood but not regularly and the 35.78% donate blood regularly.

Table 1. Response rates and percentage for the main question on blood donation

Responses to the question on blood donation behaviour	N	%	% Cum.
Has never donated blood	292	44.65	44.65
Has donated blood in the past	56	8.56	53.21
Donates blood but not regularly	69	10.55	63.76
Donates blood regularly	234	35.78	99.54
Does not answer to the question (Missing)	3	0.46	100
Total	**654**	**100.00**	

The analysis of the open question completes the list of reasons for not donating. As a result, we observe that 29% of the non-blood donors do not donate because of health reasons. Fear (14.73%) and have not thought about it (9.59%) are also important reasons according to our subsample of non-blood donors. The open question emerges some important reasons that our initial list of reasons did not consider. Some individuals report having a temporary health problem (5.48%), or not being motivated enough for donating (6.51%).

Table 2. Reasons for not donating for the Non-Blood Donors

Reasons for not donating	Freq.	Percent	Cum.
Does not trust the Health Care System	6	2.05	2.05
Fear	43	14.73	16.78
Has not thought about it	28	9.59	26.37
Lack of awareness of the need	18	6.16	32.53
Other people donate	5	1.71	34.25
Health reasons	87	29.79	64.04
Lack of motivation	19	6.51	70.55
Temporary Health problem	16	5.48	76.03
Feeling dizzy	3	1.03	77.05
Lack of information	6	2.05	79.11
Does not Answer	61	20.89	100.00
Total	**292**	**100**	

With the responses to these three questions we distinguish the following groups of blood donors:

- Regular Blood donors: those who report to donate blood regularly in the first question
- Non-Regular Blood Donors: those who state to donate blood, but not regularly
- Potential Donors: those who have never donated blood but do not choose "health reasons" as the main reason for it
- Refused donors: individuals who have never donated because of health reasons
- Past donors: they have donated blood in the past but stopped)
- Non-Donors who are not identifiable because information about the reason for not donating is missing (they did not answer to that question).

Table 3. Classification of Blood Donors in the working sample

Blood Donors' classification	N	%	% Cum.
Regular donors	234	35.78	35.78
Non –Regular donors	69	10.55	46.33
Potential	144	22.02	68.35
Refused	87	13.30	81.65
Past	56	8.56	90.21
Non Donor by unknown reason	61	9.33	99.54
Missing	3	0.46	100.00
Total	**654**	**100.00**	

Concerning living organ donations module of the questionnaire, donor groups are

identified depending on the answer to the following question: *"Would you be willing to donate a liver/kidney to a relative if you faced such a decision?"*

The following table shows that the 54.59% of the respondents would be completely agree on donating an organ in life to a relative. We also observe that only a few individuals disagree with this question, but the percentage of no answer is quite high (18.35%).

Table 4. Willingess to Donate an Organ in life (WTD)

WTD	N	%	% Cum.
Completely Agree	357	54.59	54.59
Somewhat Agree	140	21.41	75.99
Somewhat Disagree	4	0.61	76.61
Completely Disagree	2	0.31	76.91
Does not know	31	4.74	81.65
Missing	120	18.35	100.00
Total	**654**	**100.00**	

The dependent variables for the regression models are created using this classification. For the case of blood donations we aim to compare the different groups of donors, therefore we will estimate three probit models:

- Model 1: Comparison between Blood Donors and Potential Donors. The dependent variable of this model is a dummy which takes value 1 if the individual is or has been a blood donor at least once in life, and 0 if the individual is a Potential Blood Donor (has chosen a reason for not donating different from health reasons)
- Model 2: Comparison between Active Donors (regular or not, but excluding the past donors) and potential donors (excluding the individuals who are not donors because of permanent exclusion due to health reasons)
- Model 3: Compares Regular Donors with Non-Regular Donors, excluding therefore all the individuals who are not blood donors.

For the analysis of living organ donations, we estimate a probit model in which the dependent variable is the willingness to donate an organ in life to a relative. We aggregate levels of disagreement with those who do not know what to answer to this question, interpreting these three answers as a "low willingness to donate". For the regression model the dependent variable will take value 1 if the individual completely agrees with donating an organ in life, and 0 otherwise (if he is not completely willing to donate). As independent variables we include age, gender and education as control

variables, the expected effects (benefits and costs) of donation, and other aspects related to donation such as having donor predecessors, information and trust in the Health Care System. Concerning the control variables, in the questionnaire we asked individuals about their gender and age in years. For the descriptive and regression analyses we create dummy variables for gender (men/female) and age ranges [18-29], [30-39], [40-49], [50-59], [60-67] such that each individual is allocated in one of the age ranges according to his/her age. The oldest individual in our sample is 67 years old and there is nobody under 18. All individuals considered in our sample are therefore in age of donating. The question concerning the level of education considered four categories: Without Education, Primary School Studies, Secondary School Studies, and Superior Studies (College and University or similar).

The expected benefits and costs of donating blood and living organs

For each of these questions on the expected benefits and costs, individuals selected their level of the agreement on a 5-leveled Likert scale: 1-Completely Disagree, 2-Somewhat Disagree, 3-Somewhat Agree, 4-Completely Agree, and 5-Do not Answer.

- The expected costs of donating blood or living organs, material or non-material. The questions, respectively for blood and living organs are "*Do you think that donating blood has some costs, material or non-material?*", and "*Concerning the expected costs of donating an organ in life, do you think there might be consequences on your future health if donating an organ in life?*"
- The perceived benefit from the mere fact of donating (the *per-se* benefit for donating blood and living organs). "*Do you think that there should be some benefit from the mere fact of donating, which is independent from the success of donation, when donating blood?*" and "*The very fact of donating an organ in life should provide personal satisfaction".*
- The perceived benefit due to the improvement of someone else's welfare as a consequence of donation. "*Do you think that there should be some benefit associated with the success of donation in the sense that the benefits from the donation for the recipient make you happier when donating blood/a living organ?*" and *Donating an organ in life is contributing somehow to improve the well-being of the whole society.*

We hypothesize that there is an influence of the expected benefits and costs on the decision of donating blood and living organs. We will check not only for the importance of this benefits and costs, but also for the differences between groups and type of donations.

Information and trust factors

We include questions to know how much individuals are informed about donations, if they think there is enough information about blood donations in the media or from the health care system, if they think they have enough information about the complexity of the procedure of donating an organ in life, or how much they trust in the Health Care System, specifically in the field in charge of blood collection and transplantation.

We hypothesize that information concerning blood and living organ donations reduces uncertainty about the donation process and therefore increases the probability of being a donor.

The influence of having donor predecessors

We also include a variable in the regression models that indicates if the individual knows the existence of blood or organ donor predecessors among relatives.

The hypothesis to be tested is if those individuals who report having blood and organ predecessors are more likely to donate blood or to be more strongly willing to donate an organ in life than those who do not know the existence of predecessors among their relatives.

4. Results

4.1 Descriptive Results

The following results from the questionnaire are analyzed here: i) descriptive statistics by groups blood and living organ donors, and ii) regression results for the analysis of the determinants of blood and living organ donations for a given population and by groups of donors.

The final sample size is N=654 respondents, with 453 responses (the 69.27%)

collected from the staff of the university community and 201 (the 30.73%) from the blood donors' association. There are only three individuals who did not answer to the main question to know if they are or not blood donors. These individuals will be removed for the analysis. We also remove all the individuals who did not answer to the questions concerning age and gender, leaving a final working sample of N= 529 individuals for the analysis. The table below shows the distribution of respondents among the different groups of blood donors according to their responses to all the variables of interest.

We observe that comparing by gender, women responding to our questionnaire are much more refused for health reasons than men, and also donate less regularly. The distribution by age shows that in our sample, the youngest respondents, those aged 18-29, are, in a higher proportion, regular and potential blood donors. There is an important rate of no response to that question, but most of the individuals not responding to that information are non-blood donors who have neither responded to the reason why they are not blood donors. Among our respondents answering to information concerning their educational level, we observe that the majority has reached the University level or secondary studies. There are only a few individuals who report having reached Primary School. For those who have reached Secondary and University levels, results show that the percentage of regular donors is higher than other groups. However, those reporting university are less likely to be regular donors than those with a level of secondary studies. Concerning the expected benefits and costs of donating blood, most respondents disagree completely on the perception of costs of blood donation, especially visible for regular blood donors. Potential blood donors in general do not know what to answer to that question. Most individuals agree on the perception of per-se and other-regarding benefits. For those who agree completely there seem not to be significant differences among groups of blood donors, while for those who only agree (but not completely) regular blood donors gain weight with respect to the other groups. There are differences between groups of donors according to information and trust factors. The lower the agreement on that there is enough information, either general information, or from the media or Health Care System, the lower is the weight of regular donors, indicating that for this group information is perceived as enough, while especially for the group of potential donors or the refused report the contrary, showing disagreement on these questions. Similar results are found when we ask about how much they trust in the health care system. Finally, among those who report having blood and organ predecessors among their

relatives, the 44.74% are regular blood donors.

Table 5. Distribution of responses (N and %) to the explanatory variables by groups of blood donors

Variables	Categories of response	N	% Regular	% Non-Regular	% Past Donor	% Potential	% Refused	% Non-donor (unknown reasons)
Gender	Women	284	27.11	15.14	8.80	26.76	20.07	2.11
	Men	257	57.59	5.84	8.17	18.68	7.78	1.95
	Missing	110	8.18	10.00	9.09	18.18	9.09	45.45
Age	[18-29]	242	36.36	14.05	7.02	31.40	9.50	1.65
	[30-39]	191	37.17	8.90	9.95	19.90	20.94	3.14
	[40-49]	78	56.41	6.41	10.26	11.54	14.10	1.28
	[50-59]	3	66.67	0.00	0.00	33.33	0.00	0.00
	[60-70]	16	68.75	0.00	12.50	0.00	18.75	0.00
	Missing	121	14.88	10.74	8.26	16.53	8.26	41.32
Maximum level of Education achieved	Primary School	42	83.33	9.52	4.76	2.38	0.00	0.00
	Secondary School	106	65.09	14.15	1.89	8.49	8.49	1.89
	University	175	44.00	12.00	6.29	19.43	16.00	2.29
	Without Studies	1	100.00	0.00	0.00	0.00	0.00	0.00
	Missing	327	15.90	8.87	12.54	30.58	15.29	16.82
There is a cost, material or not, from donating blood	Completely Agree	58	20.69	3.45	8.62	41.38	24.14	1.72
	Somewhat Agree	120	24.17	13.33	10.83	35.83	15.00	0.83
	Somewhat Disagree	66	48.48	7.58	1.52	25.76	15.15	1.52
	Completely Disagree	280	49.29	11.43	8.21	16.07	13.93	1.07
	Does not know	22	9.09	9.09	4.55	59.09	18.18	0.00
	Missing	105	20.00	11.43	12.38	1.90	1.90	52.38
There is a benefit for the very fact of donating (per-se)	Completely Agree	407	39.07	10.07	7.62	24.32	17.69	1.23
	Somewhat Agree	129	37.98	13.18	9.30	28.68	10.08	0.78
	Somewhat Disagree	12	50.00	0.00	8.33	33.33	0.00	8.33
	Completely Disagree	4	75.00	0.00	0.00	0.00	25.00	0.00
	Does not know	3	33.33	0.00	0.00	66.67	0.00	0.00
	Missing	96	16.67	11.46	12.50	2.08	1.04	56.25
There is a benefit due to health improvement of the recipient with donation (other-regarding)	Completely Agree	435	38.85	10.11	8.05	25.29	16.55	1.15
	Somewhat Agree	100	46.00	9.00	9.00	24.00	11.00	1.00
	Somewhat Disagree	15	26.67	13.33	13.33	46.67	0.00	0.00
	Completely Disagree	3	33.33	0.00	0.00	0.00	66.67	0.00
	Does not know	5	40.00	20.00	0.00	20.00	0.00	20.00
	Missing	93	12.90	13.98	10.75	2.15	2.15	58.06
Enough Information Concerning blood donations	Completely Agree	95	64.21	14.74	5.26	10.53	5.26	0.00
	Somewhat Agree	206	43.20	12.14	9.22	19.42	15.33	0.49
	Somewhat Disagree	171	28.65	8.19	9.94	31.58	20.47	1.17
	Completely Disagree	44	22.73	6.82	4.55	43.18	20.45	2.27
	Does not know	27	33.33	7.41	7.41	40.74	11.11	0.00
	Missing	108	14.81	10.19	10.19	9.26	2.78	52.78
Trust in the Health Care System	Completely Agree	345	51.30	10.72	8.41	15.65	13.33	0.58
	Somewhat Agree	135	25.19	12.59	8.89	30.37	21.48	1.48
	Somewhat Disagree	40	10.00	5.00	5.00	60.00	20.00	0.00
	Completely Disagree	9	33.33	0.00	0.00	55.56	11.11	0.00
	Does not know	16	6.25	6.25	18.75	62.50	6.25	0.00
	Missing	106	14.15	11.32	9.43	9.43	1.89	53.77
Enough Information from the media	Completely Agree	43	41.86	9.30	9.30	25.58	13.95	0.00
	Somewhat Agree	161	49.07	9.32	11.18	13.66	16.15	0.62
	Somewhat Disagree	216	36.11	12.96	7.87	26.39	16.20	0.46
	Completely Disagree	91	34.07	7.69	4.40	35.16	16.48	2.20
	Does not know	31	38.71	9.68	6.45	35.48	9.68	0.00
	Missing	109	14.68	11.01	10.09	10.09	1.83	52.29
Enough Information from The Health Care System	Completely Agree	84	54.76	13.10	8.33	15.48	8.33	0.00
	Somewhat Agree	199	45.23	11.06	11.06	15.08	16.58	1.01
	Somewhat Disagree	160	31.88	8.13	8.13	36.25	15.63	0.00
	Completely Disagree	51	31.37	11.76	3.92	31.37	19.61	1.96
	Does not know	48	33.33	10.42	4.17	33.33	16.67	2.08
	Missing	109	13.76	11.01	9.17	10.09	3.67	52.29
Has predecessors	Blood Predecessors	219	37.44	14.16	7.76	19.63	10.96	10.05
	Organ Predecessors	40	32.50	5.00	7.50	27.50	22.50	5.00
	Both predecessors	114	44.74	11.40	7.02	17.54	8.77	10.53
	No predecessors	246	33.47	8.57	10.20	23.67	15.92	8.16
	Does not know	33	18.18	6.06	9.09	36.36	15.15	15.15
	Total	**651**	**35.94**	**10.6**	**8.6**	**22.12**	**13.36**	**9.37**

Table 6 below shows the distribution of individuals among groups of Willingness to donate according to the different responses to each of the explanatory variables considered.

We do not observe differences between men and women distributions according to their willingness to donate living organs. There are some differences by age categories: we show that willingness to donate decreases with age.

The percentage of individuals who would agree completely on donating an organ in life to a relative is not very different depending on individuals' level of education. However, for those who agree, but not completely, it seems that the proportion of individuals being willing to donate increases with education. Those who declare a low willingness to donate are those who achieved primary studies.

Concerning the expected benefits and costs, most individuals agree on that there must be a cost from donating living organs, and this perception decreases their willingness to donate. However, there is also a perception of per-se and other-regarding benefits, such that those individuals agreeing on the existence of these benefits are those declaring maximum willingness to donate living organs.

There is a perception of incomplete information, especially among individuals who are more strongly willing to donate. Results indicate that these individuals trust in the Health Care System and are also informed about the complexity of the procedure of donating a living organ. On the contrary, those who declare lower levels of WTD do not trust the Health Care System and are not concerned about the success of donation neither are informed about the complexity of the procedure of donating a living organ.

Finally, willingness to donate seems to be higher for those individuals having predecessors of blood and organ donors among their relatives.

Table 6. Distribution of responses to explanatory variables (N and %), by groups of living organ donors

Variable		N	% Max WTD	% Mid WTD	% Low WTD	% NA
Gender	Women	284	67.02	24.91	5.96	2.11
	Men	257	63.81	26.85	7.39	1.95
	Missing	110	1.79	0.00	0.89	97.32
Age	[18-29]	242	67.08	24.28	7.41	1.23
	[30-39]	191	60.73	30.37	5.76	3.14
	[40-49]	78	66.67	21.79	8.97	2.56
	[50-59]	3	100.00	0.00	0.00	0.00
	[60-70]	16	68.75	31.25	0.00	0.00
	Missing	121	9.76	0.81	0.81	88.62
Maximum level of education achieved	Primary School	42	69.05	19.05	9.52	2.38
	Secondary School	106	65.42	27.10	5.61	1.87
	University	175	63.43	28.00	5.14	3.43
	Without Studies	1	100.00	0.00	0.00	0.00
	Missing	327	44.38	16.41	5.47	33.74
There is an expected cost of donating an organ	Completely Agree	240	59.17	31.25	8.33	1.25
	Somewhat Agree	170	68.82	25.29	5.29	0.59
	Somewhat Disagree	48	70.83	22.92	6.25	0.00
	Completely Disagree	58	77.59	13.79	8.62	0.00
	Does not know	7	85.71	14.29	0.00	0.00
	Missing	131	9.92	1.53	0.00	88.55
There is a personal benefit of donating a living organ	Completely Agree	311	72.99	21.54	5.14	0.32
	Somewhat Agree	162	58.64	37.04	4.32	0.00
	Somewhat Disagree	22	59.09	36.36	4.55	0.00
	Completely Disagree	7	85.71	0.00	14.29	0.00
	Does not know	26	38.46	19.23	38.46	3.85
	Missing	126	4.76	0.00	1.59	93.65
There is a social benefit from donating a living organ	Completely Agree	166	81.93	12.05	6.02	0.00
	Somewhat Agree	192	64.06	32.81	3.13	0.00
	Somewhat Disagree	79	54.43	34.18	10.13	1.27
	Completely Disagree	47	51.06	38.30	10.64	0.00
	Does not know	37	51.35	27.03	18.92	2.70
	Missing	133	9.02	1.50	0.75	88.72
Information concerning LOD is incomplete	Completely Agree	180	66.67	25.56	7.22	0.56
	Somewhat Agree	176	61.93	28.41	8.52	1.14
	Somewhat Disagree	92	66.30	28.26	5.43	0.00
	Completely Disagree	53	81.13	15.09	3.77	0.00
	Does not know	23	56.52	34.78	8.70	0.00
	Missing	130	8.46	1.54	0.00	90.00
Trust in the Health Care System	Completely Agree	291	72.85	19.93	5.50	1.72
	Somewhat Agree	162	58.64	35.19	6.17	0.00
	Somewhat Disagree	35	57.14	37.14	5.71	0.00
	Completely Disagree	9	33.33	44.44	22.22	0.00
	Does not know	29	62.07	20.69	17.24	0.00
	Missing	128	7.03	1.56	1.56	89.84
Concerned about the success of donation	Completely Agree	151	70.20	22.52	7.28	0.00
	Somewhat Agree	163	67.48	27.61	4.91	0.00
	Somewhat Disagree	96	64.58	28.13	7.29	0.00
	Completely Disagree	96	65.63	27.08	5.21	2.08
	Does not know	20	35.00	35.00	30.00	0.00
	Missing	128	7.03	0.78	0.00	92.19
Informed about the procedure and its complexities	Completely Agree	256	71.88	21.48	5.08	1.56
	Somewhat Agree	150	63.33	31.33	5.33	0.00
	Somewhat Disagree	38	65.79	31.58	2.63	0.00
	Completely Disagree	11	63.64	27.27	0.00	9.09
	Does not know	71	53.52	28.17	18.31	0.00
	Missing	128	6.25	2.34	1.56	89.84
Has Predecessors	Blood	219	55.25	22.83	6.39	15.53
	Organs	40	47.50	15.00	15.00	22.50
	Blood and Organs	114	60.53	23.68	0.88	14.91
	No predecessors	246	52.44	20.33	6.10	21.14
	Does not know	33	54.55	21.21	3.03	21.21
	Total	**654**	**54.59**	**21.41**	**5.66**	**18.35**

To validate our analysis we need to check that our sample is similar to the real population in some background characteristics. As we have population data of the general

population, we are going to compare the population of blood and non-blood donors that were registered in the region of Navarra in the census at the same time the data were collected (May-June 2010). We use the published data from the National Institute of Statistics in Spain (INE) and recruit information on the population by gender and age ranges in Navarra to be compared with the proportions by age and gender in our sample in the same period.

We observe that the proportion of men and women in the population of Navarra during the period of May-June 2010 (0.510 and 0.490 respectively) was not so different from the proportion of men and women from the data collected (0.464 and 0.536 respectively). If we look at the proportion of men and women by age ranges we have some important differences, due to the small number of observations in some age categories, such as the individuals over 60 years old who are under-represented among our respondents. However, we can say that our sample is very similar to the real population at the moment of the data collection in terms of gender and for the people aged 18-67.

Table 7: Population and Sample by age ranges and gender. Period: May-June 2010

	Population (Source: Census data May 2010)						**Sample (Source: Questionnaire May 2010)**					
	Men		**Women**		**Total**		**Men**		**Women**		**Total**	
	N	Prop	N	Prop	N	Prop	N	Prop	N	Prop	N	Prop
18-29	42939	0.512	40938	0.488	83877	1	37	0.370	63	0.630	100	1
30-39	54735	0.521	50272	0.479	105007	1	61	0.427	82	0.573	143	1
40-49	50216	0.515	47381	0.485	97597	1	78	0.411	112	0.589	190	1
50-59	39287	0.503	38866	0.497	78153	1	54	0.692	24	0.308	78	1
60-67	25541	0.491	26515	0.509	52056	1	16	0.842	3	0.536	19	1
Total	**212718**	**0.510**	**203972**	**0.490**	**416690**	**1**	**246**	**0.464**	**284**	**0.536**	**530**	**1**

4.3 Regression Methods and Results

We estimate four probit models: three models for the case of blood donations, each of them differs on the dependent variable, in order to analyze how the same determinants of blood donation (independent variables are the same for all the models) influence the different groups of blood donors, analyzing these differences between groups; and one model for the case of living organ donations, to analyze the difference between the two groups of living organ donors according their willingness to donate:

high or mid-low (these two are aggregated due to the small number of individuals in the lowest level of willingness to donate).

The probit model is expressed as:

$$\Pr(y_i \neq 0 \mid x_j) = \phi(x_i \beta)$$

where ϕ is the standard cumulative normal, y_i is a discrete dependent variable that we want to explain, and x_i are the independent variables. In our case, our dependent variables are binary, representing each of the groups of donors, so that y_i=1 if the individual belongs to the group of interest and 0 otherwise. For each of the regression models we exclude all the missing values of the independent variables except for education. For this variable we consider the non-response (missing) as an additional category of response, given that half of the sample did not answer to this question.

Results from the regression models on attitudes towards blood donations are shown in table 8. We observe the following results (marginal effects for each factor are provided, *dy/dx* representing the variation of the probability of *y=1* associated to the factor *x*).

We do not find differences by gender and age between active and potential blood donors. However, men are more likely than women to be regular donors (+0.281), and also individuals aged 40 to 50 years old are more likely than the youngest donors (aged 18-29) to be regular donors (+0.210).

Concerning the expected benefits and costs, those who disagree with the perception of costs are more likely to be active donors than potential donors (+0.222), while there are no differences found between active and potential donors in the perception of per-se and other-regarding benefits (descriptive results have shown that both groups agree on the existence of such benefits from blood donation) neither between regular and non-regular donors in the perception of costs.

Not agreeing completely on that information on blood donations is enough, or not trusting completely the Health Care System increases the probability of being a potential donor while not agreeing completely on that information from the media is enough increases the probability of being an active donor.

Comparing regular and non-regular donors, this fact increases the probability of being a non-regular donor (-0.144).

Table 8. Regression results of probit models: Blood Donations. Marginal effects are shown (dy/dx)

Variable	Category	Active (1) vs Potential (0)	All Blood Donors (1) vs Potential (0)	Regular (1) vs Non-Regular (0)
Gender	men	0.072	0.072	0.281***
Age	30-39	-0.016	-0.015	0.084
	40-49	0.057	0.090	0.210***
	50-59	-1.469	-0.204	(empty)
	60-70	(empty)	(empty)	(empty)
Education	Secondary Studies	-0.015	-0.028	0.016
	University	-0.149	-0.135	0.080
	Without studies	(empty)	(empty)	(empty)
	Missing	-0.349***	-0.282***	0.032
Cost	Somewhat Agree	0.097	0.079	-0.202
	Somewhat Disagree	0.199**	0.132	0.035
	Completely Disagree	0.222***	0.203***	0.000
	Does not know	-0.113	-0.088	-0.402
Per-se benefit	Somewhat Agree	0.033	0.019	-0.086
	Somewhat Disagree	0.046	0.008	(empty)
	Completely Disagree	(empty)	(empty)	(empty)
	Does not know	-0.259	-0.297	(empty)
Other-regarding benefit	Somewhat Agree	0.044	0.041	0.041
	Somewhat Disagree	0.026	0.050	0.152
	Completely Disagree	(empty)	(empty)	(empty)
	Does not know	(empty)	(empty)	-0.279
Information is enough	Somewhat Agree	-0.156**	-0.131**	0.039
	Somewhat Disagree	-0.227***	-0.191***	0.088
	Completely Disagree	-0.388***	-0.402***	0.175
	Does not know	-0.290**	-0.220	0.106
Trust in the Health Care System	Somewhat Agree	-0.145***	-0.141***	-0.144**
	Somewhat Disagree	-0.350***	-0.323***	-0.423
	Completely Disagree	-0.372**	-0.403***	(empty)
	Does not know	-0.529***	-0.259*	-0.094
Enough Information from media	Somewhat Agree	0.396***	0.364***	-0.113
	Somewhat Disagree	0.387***	0.358***	-0.227***
	Completely Disagree	0.403***	0.338***	-0.052
	Does not know	0.382***	0.37**	-0.041
Enough Information from HCS	Somewhat Agree	-0.069	-0.067	-0.056
	Somewhat Disagree	-0.158	-0.139	0.013
	Completely Disagree	0.042	0.025	-0.200
	Does not know	-0.101	-0.153	-0.173
Has predecessors	Organs	-0.096	-0.064	0.145
	Blood and Organs	0.020	0.041	0.015
	No predecessors	-0.010	-0.003	0.011
	Does not know	-0.153	-0.080	-0.194
N		**355**	**394**	**226**
Log likelihood ratio		**183.15**	**154.24**	**69.61**
Pseudo R2		**0.402**	**0.317**	**0.288**

Note: dy/dx for factor levels is the discrete change from the base level.

We estimate now the regression model on attitudes towards living organ donations (Table 9). We observe the differences between individuals according to their willingness to donate an organ in life to a relative.

We do not observe differences between men and women, neither by ages or education. However, not agreeing completely and not being sure of the existence of costs increases the probability of being more willing to donate. Disagreeing completely with the existence of a per-se benefit and not agreeing completely with the existence of other-regarding benefit from living organ donations increase the probability of being willing to donate (both results with respect to complete agreement which is the base level). Other significant factors are trust in the Health Care System and being concerned about the donation success. On the one hand, we observe that individuals who completely disagree (in other words, who do not trust the Health Care System), in

comparison with those who trust the Health Care System, are more likely to have a lower willingness to donate living organs. On the other hand, those who are not sure about being concerned on the success of donation are more likely to not being willing to donate an organ in life.

Table 9. Regression Results of probit model: Living Organ Donations. Marginal Effects are dy/dx

Variable	Variable	Max WTD (1) vs Other WTD (0)
Gender	Men	-0.018
Age	30-39	-0.028
	40-49	0.028
	50-59	(empty)
	60-70	-0.046
Education	Secondary Studies	0.056
	University	0.048
	Missing	0.094
Cost	Somewhat Agree	0.134***
	Somewhat Disagree	0.106
	Completely Disagree	0.095
	Does not know	0.377***
Per-se benefit	Somewhat Agree	-0.059
	Somewhat Disagree	0.020
	Completely Disagree	0.274***
	Does not know	-0.182
Other-regarding benefit	Somewhat Agree	-0.153***
	Somewhat Disagree	-0.216***
	Completely Disagree	-0.277***
	Does not know	-0.114
Information is Incomplete	Somewhat Agree	-0.071
	Somewhat Disagree	-0.075
	Completely Disagree	0.061
	Does not know	-0.077
Trust in the Health Care System	Somewhat Agree	-0.086
	Somewhat Disagree	-0.067
	Completely Disagree	-0.418**
	Does not know	-0.022
Concerned about the success of donation	Somewhat Agree	-0.007
	Somewhat Disagree	-0.023
	Completely Disagree	-0.048
	Does not know	-0.398***
Informed about the complexity of the living organ donation process	Somewhat Agree	-0.050
	Somewhat Disagree	-0.051
	Completely Disagree	-0.160
	Does not know	-0.088
Has predecessors	Organs	-0.083
	Blood and Organs	-0.008
	No predecessors	0.008
	Does not know	0.070
N		**495**
Log Likelihood		**80.41**
Pseudo R2		**0.126**

5. Discussion

The theoretical model we proposed could be extended to a non-linear context, considering the case of interactions between self-interest and altruism. However, we consider that this model is enough for describing the decision of becoming or not a donor even under the assumption of complementary self-interested and altruistic preferences. This assumption helped to simplify the results of the model and to analyze separately the

influence of the expected benefits and costs of donating blood or living organs.

The empirical work provides a description of the different types of blood and living organ donors, even if the sample of study is not representative of the general population. If we look at the proportion of blood and non-blood donors in our sample and compare it with the proportion of blood and non-blood donors in the population at that period, we observe that we have an over-represented population of blood donors, with a 55.1% of respondents who declare to have donated blood at least once in their live, while the real percentage of blood donors in the population was 7.3%. However, given that our aim was to compare the different types of blood and living organ donors, we consider that representativeness is not a strong limitation of the work. A stronger limitation could the fact that our sample is restricted to the university population (we have a problem of sample selection). However the high proportion of blood donors among respondents was not a surprise. We consider that our study provides information that could be interesting for policy makers in the context of blood and living organ donations. Including some questions in the National Health Survey would be however more than desirable.

6. Concluding Remarks

The behavioral model developed in this paper examines the decisions of individuals for and against blood or living organ donation. Specifically, it applies to an individual who is considering donating blood or an organ. The ultimate decision depends on the expected future benefits and costs incurred because of donation and how these factors are weighted by the individual's degree of altruism. Perceptions of the donation costs are significantly different for blood donors than for non-blood donors. Regarding the benefits and costs of individuals who would be willing to donate an organ versus individuals who would not, the differences in costs and *per-se* and other-regarding benefits are significant.

The empirical analysis explores and identifies, for our sample, the differences between groups of donors, according to control variables, expected benefits and costs of donation, and other factors related to information provided about both kind of donations and trust in the Health Care System.

Our results show how these factors affect to the different groups of blood and living organ donors. We confirm the importance of the expected costs and per-se and other

regarding benefits, and show not only that there are differences on how the different groups of donors perceive such effects, but also that there are differences between blood and living organ donations. Information and trust in the Health Care System are also significant factors that should be taken into account when designing policies to attract potential donors. In general, we give response to our hypothesis and we are able to give a description of the different groups of blood and living organ donors that could be useful for policy makers in the context of blood and living organ donations.

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2

Incentives when altruism is impure: The case of blood and living organ donations

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Incentives when altruism is impure:
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Abstract

The decision to donate blood and living organs is considered voluntary and altruistic. However, the shortage of donors has opened an interesting debate in recent years, considering offering economic incentives to donors. This paper analyzes theoretically and empirically, the effects of incentives over individuals when facing the decision of becoming donors. Theoretically we show how altruism could be affected by the introduction of incentives and modify individuals' behaviour when facing the decision of donating blood and living organs. Empirically, we include some questions on incentives in a broad questionnaire on blood and living organ donations in a university population. As a proxy for crowding-effects we use the individuals' attitudes towards incentives, attitude being measured by an agreement/disagreement scale. Results show that crowding-in of blood donors would be more likely by offering "Information concerning blood donations" or "Blood Tests". In both, blood and living organ donations, "Money" would be very likely to crowd-out individuals from donating. Concerning living organs, we do not find good evidence for crowding-in. We conclude donation policies, properly designed, could help to increase the number of donors, and more specifically suggest implementing non-monetary incentives.

Keywords: Social preferences, Incentives, Altruism, Blood and Living Organ Donations

1. Introduction

Blood and living organ donations are voluntary and altruistic. Donation in these cases is somehow particular, as individuals who donate are not expecting a compensation for donating (Fortin et al., 2010), but donate for altruistic reasons. This means that individuals are not only self-interested but are also concerned about the others' payoffs (Charness and Rabin, 2002; Andreoni, 1990).

Blood cannot be artificially created and there is an increasing need of organs for transplantation. Evidence shows that even if all the deceased donors actually donate, unfortunately this would not be enough to cover the growing demand for organs (Israni et al., 2005) and, as a consequence, the waiting lists do not stop increasing. Encouraging blood and living organ donations is therefore necessary.

The effect of introducing incentives for pro-social activities has been analyzed not only in the field of economics but is also popular in psychology, sociology and other fields. Recent research concludes that incentives do influence social values, and also that social preferences are important influences on individuals' behavior (Bénabou and Tirole, 2006; Bowles and Polanía, 2012). The question of how incentives affect individuals' behaviour for the specific case of blood and living organ donations is addressed in this paper.

Behind this question is the Motivation Crowding Theory (Deci and Ryan, 1985; Frey and Jegen, 2001). This theory of crowding-effects stipulates a systematic interaction between intrinsic and extrinsic motivation, both influencing human behavior. For instance, it predicts that external interventions, via economic incentives or punishments, may undermine intrinsic motivation. However, experimental studies have demonstrated that it cannot be said that incentives always discourage pro-social activities (Lacetera, Macis, 2010).

The debate of crowding-effects in blood donations was introduced by Richard Titmuss (1970), who analyzed the effect of introducing economic incentives for donating blood. He concluded that economic incentives crowd-out (expel) more blood donors than they crowd-in (attract). According to this author, this may be due to the partial destruction of intrinsic motivation when price mechanisms are introduced. But some researchers (Solow, 1971; Arrow, 1972; Bliss, 1972), attracted by these findings, reviewed Titmuss work and criticize it, arguing that results were not sufficient to conclude that incentives crowd-out blood donors.

The Motivation Crowding Theory suggests that economic incentives sometimes may reduce the total supply of certain goods when individuals have social-preferences towards those goods (Frey and Oberholzer, 1997). For some individuals, incentives may be perceived as signals of permissible behavior (Mellstrom and Johannesson, 2008), provide information about the policy makers or in general about the person who implements the incentive (Fehr et al., 2007; Irlenbusch and Ruchala, 2008; Ariely, Bracha and Meier, 2009). But there is also evidence of crowding-in when using incentives, some individuals being attracted by the incentive (Falk, Gächter and Kovacs, 1999; Gächter and Falk, 2002; Lacetera and Macis, 2010) while some others could adapt their preferences to incentives (Bowles and Polanía, 2012) or react positively to incentives accepting them as a compensation of a socially beneficial action.

Some research studies have analyzed the introduction of incentives in the market for live and cadaveric organ donations (Becker and Elías, 2007) demonstrating that monetary incentives could increase the supply of organs for transplantation and even reduce the waiting lists for an organ. In the context of blood donations, Lacetera and Macis (2010) showed that some individuals, especially those who recently became donors, did not show aversion to direct cash incentives, while women -especially among active or regular donors- reported a stronger aversion to cash incentives. They concluded that offering monetary payments, a high proportion of active donors would stop donating. However, other kind of incentives, like vouchers (indirect cash of the same nominal value than the monetary incentive) were better supported. The same authors, in another experiment showed that symbolic incentives such as medals or publishing the name of donors in a local journal where better blood donation motivators than monetary compensations (Lacetera and Macis, 2008). In addition, other authors, in a field experiment, compare the effect of lottery tickets versus a free cholesterol test, showing that offering lottery tickets in compensation to blood donors significantly increased blood donations (Goette and Stutzer, 2009).

The risk of existence of crowding-out suggests that, in some circumstances, it is advisable not to use the market model to elicit a higher supply as sometimes incentives can have an effect which is the contrary to the one predicted by the conventional economic theory, according to which incentives increase supply. In such cases, and this could be the case of blood and living organ donations, it is recommended not to rely on monetary payments but on a different type of incentive (Frey and Jegen, 2001). Certain incentives could attract some self-regarding individuals who suddenly will be willing to

become donors. For example, mechanisms based on information –called exhortation mechanisms– could be effective increasing individuals' willingness to donate (Thorne, 1998). The final result, net crowding-in or crowding-out, depends on the type of incentive (monetary or non-monetary), the nature of the task to perform (individual/private versus social/public decisions), and on characteristics of the population involved (altruistic or self-interested).

This paper addresses the question of how incentives influence behavior and decision making, specifically for individuals who have latent social preferences. We center this question, and focus on the specific context of blood and living organ donations. We analyze how individuals' behavior may be influenced by incentives, monetary and non-monetary, using theoretical approach and empirical research. From a policy making perspective, we look for the best incentive in case of being implemented would maximize the gap between attracted and dissuaded individuals. The aim is to suggest, according to our results, an incentive mechanism for attracting new donors at the same time that minimizes the crowding-out of active donors.

We develop a theoretical model that analyzes how individuals' decision of donating blood and living organs could be different when incentives are offered with respect to the status-quo where no incentive is offered. We measure crowding-effects of incentives looking at the changes in individuals' utility when incentives are introduced in the set of variables that influence individuals' decision making. The model is general for both kinds of donations. We assume that behind the decision of becoming or not a blood or living organs are social preferences.

Empirically, we analyze individuals' responses of individuals from a selected population to a broad questionnaire on attitudes towards blood and living organ donations where we included some questions on incentives. We explore the individuals' levels of agreement/disagreement with different incentive mechanisms in a population of blood donors and staff from a university population.

The paper is organized as follows. In section 2, we study, through a model of expected utility, how incentives could affect individuals' behavior. We analyze the motivation crowding effects and provide the model results. In section 3 we present the questionnaire on attitudes towards blood and living organ donations, and analyze, through descriptive statistics and regression models, the relationship between incentives and individuals' willingness to donate blood or living organs. Section 4 opens a discussion and the paper concludes in section 5 where we comment the most relevant

aspects and results of this study, and mention the implications for future research or public policies.

2. The Model

Denote by $I=\{1,\ldots,n\}$ the set of individuals who face the decision of becoming or not blood/living organ donors, and $J=\{1,\ldots,m\}$ the set of potential recipients (that is, the total number of individuals waiting for a transfusion or an organ transplantation of a kidney or a liver in a population of size P).

Suppose there is a society S that experiences the following problem: the number of individuals waiting for a transfusion or in waiting list for organ transplantation is strictly higher than the number of donors (which is a partition of I). Therefore, in this society, the government or similar decision maker is evaluating the possibility of offering some incentive in order to reduce the gap between supply and demand. Note that, if the demand is fully covered, incentives will not be necessary. The decision maker however needs to know how potential donors would react to incentives. To help the decision maker to take a decision on incentives, an effort to disentangle the psychology behind the decision of donating blood and living organs is needed.

The model we develop assumes that individuals face the decision to donate or not more than once. We will call t to the individuals' time horizon, for $t= A,\ldots,A+L_i$. The time horizon goes from the first time the individual decides if he/she is willing to become or not a donor ($t=A$, where A is the age of the individual at that time) until the last time the individual makes such a decision. The individual may stop to be willing to donate anymore or may be asked to stop donating because of age or health reasons, either permanently or temporarily. However, whatever the reason is, this does not have implications on the model results.

We propose a utility function for any individual $i \in I$ who faces the decision of becoming or not a donor at time t. The expected utility of becoming a donor is a function of the following arguments: the consumption of goods and services, the expected costs and benefits for donating, and the external intervention (the incentive).

$$U_{i,t} := U_{i,t}\left(X_{i,t}, C_{i,t}, S_t, G_{i,t}, U_{j,t}\right) \qquad (1)$$

The first argument, X_i, represents the classical set of goods and services which consumption provides a certain level of utility to individuals. C_i represents the expected costs of donation; S represents the incentive, G_i represents the very pleasure of giving, that is, the "warm-glow" (Andreoni, 1990) and reflects the individual pleasure for the very fact of giving which is independent of whether the donation is successful or not for the recipient, and U_j the expected utility for the recipient $j \epsilon J$. We assume j is unknown in the case of blood donations, and known in the case of living organ donations, focused the later on donation between relatives only. The individual observes the realization of each variable (measured by utility units) at each time t in the decision time horizon.

We assume that individuals are in part self-interested so that they donate in part by egotistic reasons such as pride or social acceptation, but also that in part they donate because of altruistic reasons, such as the pleasure of the very fact of giving and the expected health improvements for the recipient when receiving the donation. In other words, individuals are defined by "other-regarding preferences". These models, considering altruistic individuals, other-regarding behavior and social values, have been analyzed previously in the literature (Becker, 1976, Simon, 1993, Bowles and Polanía, 2012).

The model considers that an individual, when making a decision at a certain time point, considers not only the benefits and costs at that time but also makes expectations about the future benefits and costs, and these expectations also account for the decision of donating blood or living organs. The standard assumption of positive temporal preferences is made, so that the expected utility for donating at time t for the individual i is the discounted sum (the sum is represented by the integral and is the discount factor) of the expected utility along the time horizon. The following expression represents the expected utility of the decision of becoming a donor at any time point on the time horizon that goes from $t=A$ to $t=A+L_i$:

$$U_{i,t} = \int_t^{t+L_i} e^{-\rho \cdot t} \cdot \left[x_{i,t} - c_{i,t} + s_t + a_{i,t}(S) \cdot \left(g_{i,t} + u^{\beta_i}{}_{j,t} \right) + \lambda_{i,t} \cdot s_t^{\alpha_i} \right] \cdot dt \quad , \forall t \geq A \qquad (2)$$

where A represents the age of the individual at the first time facing such a decision and L_i is the last time and individual faces that decision (either voluntarily or compulsorily for reasons of health or age); $a_{i,t}$ is the degree of altruism ($a_{i,t} \epsilon R^+$) which is a function of incentives, and $\lambda_{i,t}$ the propensity ($\lambda_{i,t} > 0$) or aversion ($\lambda_{i,t} < 0$) to accept incentives for

that individual at that time, α_i and β_i are the elasticities of the utility of the i-individual from incentives and from the utility of the recipient, respectively, and the discount factor ρ indicates a positive depreciation of the total utility over the time.

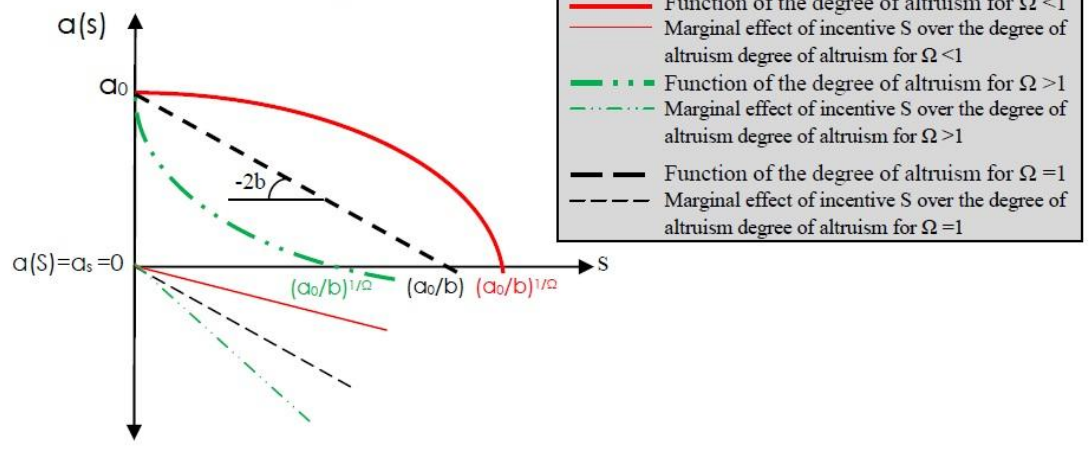
Similar to other models in the literature (Bowles and Polanía, 2012), we assume altruism is a function of incentives. The difference is that we propose a non-linear function, assuming that not all the units of the incentive *S* affect equally to the degree of altruism. The function of altruism proposed is the following:

$$a_{i,t} = a_{0,i,t} - b_{i,t} \cdot s_t^{\Omega_{i,t}} \qquad (3)$$

We assume that $\partial a / \partial s \mid_t \leq 0$, so that receiving positive quantities of an incentive *S* reduces the individuals' degree of altruism from the initial degree of altruism.

Only for simplicity, lets' give a value to parameters alpha and omega $\alpha_i = \Omega_i = 2$, such that each unit of incentive *S* provokes a reduction of the degree of altruism equal to $\partial a / \partial s = -2bs$, for *b* taking strictly positive values and with a random distribution in the support $b \in [\underline{b}, \bar{b}]$. The function for the degree of altruism and the marginal effects of incentive over that function is represented in figure 1 below. A result that is clear in that figure is that the lower (higher) the value of parameters *b* and Ω, the higher (lower) is the incentive that the individual would be willing to accept before the degree of altruism is zero.

Figure 1. The degree of altruism as a function of incentives (a(s) is the function and a_s the marginal effect of the incentive over the degree of altruism)



Including the function proposed for the degree of altruism in the utility function, it can be rewritten as follows:

$$U_{i,t} = \int_{t}^{t+L_i} e^{-\rho \cdot t} \cdot \left[x_{i,t} - c_{i,t} + s_{i,t} + \left(a_{0,i,t} - b_{i,t} \cdot s^{\Omega}{}_{i,t} \right) \cdot \left(g_{i,t} + u^{\beta_i}{}_{j,t} \right) + \lambda_{i,t} \cdot s^{\alpha_i} \right] \cdot dt \,, \forall t \geq A \quad (4)$$

Under the standard assumption that individuals are utility maximisers, they will decide to become donors if and only if the expected utility of becoming a donor is positive higher than the utility of deciding not to become a donor ($U^0_{i,t}$). For simplicity, we assume that this utility is zero, $U^0_{i,t} = 0$.

We will focus first on analyzing all possible crowding-effects of incentives as variations in the individual's marginal and total utilities when incentives are offered.

The Motivation Crowding Effects are analyzed through the variations in the utility for each additional unit of incentive. By offering an incentive *S* three different effects on the marginal utility are possible:

1. Crowding-in: for each additional unit of the incentive, utility increases in a higher proportion. That is $U_s > 0$ and $U_{ss} > 0$.

2. Weak Crowding-Out: for each additional unit of the incentive, utility increases in a lower proportion. That is $U_s > 0$ and $U_{ss} < 0$.

3. Strong Crowding-Out: The utility of becoming a donor decreases when incentives are introduced into the utility function with respect to the status-quo, whatever the quantity of incentive is ($U_s < 0$).

A sensitivity analysis easily shows how depending on the values of the parameters of the model (we simplify the expression (4) by assuming $\alpha_i = \Omega_i = 2$), the individual would be crowded-in or crowded-out for the same quantity of incentive offered s_i. Our interest, however, is to derive a general expression, from the model, to describe individuals' reaction to incentives in which all the possibilities of behavior are identified. We will therefore be able to determine the incentive threshold that would lead individuals to adopt different behaviors. The first thing we need is to derive the expression for the marginal utility from the incentive for any individual, which is:

$$U_s = e^{-\rho \cdot t} \cdot \left[1 - 2 \cdot b_{i,t} \cdot s_{i,t} \cdot \left(g_{i,t} + u^{\beta_i}{}_{j,t} \right) + 2 \cdot \lambda_{i,t} \cdot s_{i,t} \right] \Big|_{t=L_i} \quad (5)$$

Making that expression equal to zero we find the threshold incentive, *s**, for any individual, that is to say the incentive that would leave individuals indifferent between receiving and not receiving a quantity *s** of incentive in compensation for donation. This threshold incentive is represented by the following expression:

$$s^* = \frac{1}{2 \cdot b_{i,t} \cdot \left(g_{i,t} + u^{\beta_i}{}_{j,t}\right) - \lambda_{i,t}} \qquad (6)$$

It can be deduced from this result that, the rest of the parameters being equal for both individuals, the optimal incentive for individuals who are averse to incentives ($\lambda_{i,t}$ <0) would be lower than for individuals who are more prone to incentives.

$$s^*\left(\lambda_{i,t} > 0\right) > s^*\left(\lambda_{i,t} < 0\right) \qquad (7)$$

This result can be generalized as it is done in the following proposition:

Proposition 1: For any pair of individuals *{1,2}* ϵ *I* with the same values of *b*, *g*, and $u^{\beta}_{j,:}$

- If individuals have propensity to incentives, so that $\lambda_{i,t} > 0$, it is true that those individuals with higher propensity would accept higher quantities of the incentive: $s^*(\lambda_{1,t}) \geq s^*(\lambda_{2,t}) \leftrightarrow \lambda_{1,t} \geq \lambda_{2,t}$
- If individual 1 has propensity to incentives and individual 2 is averse, it is true that the first will accept a higher quantity of the incentive than the second.
- If both individuals have aversion to incentives, and for the individual 1 more averse than the individual 2, the first individual would accept lower quantities of the incentive: $s^*(\lambda_{1,t}) \leq s^*(\lambda_{2,t}) \leftrightarrow \lambda_{1,t} \leq \lambda_{2,t}$

Also, according equation 6, the higher the value of *b*, the lower the incentive that would be accepted. This result leads to the following proposition.

Proposition 2: For any pair of individuals *{1, 2}* ϵ *I* with the same values of λ, *g*, and $u^{\beta}_{j,}$: if individual 1 has a higher value of *b* than individual 2, being stronger the negative effect of incentives over the degree of altruism, the maximum incentive that individual 1 would be willing to accept is smaller than the incentive that individual 2 would be willing to accept.

Proof for propositions 1 and 2: We can write the expressions for the disutility of an individual who is prone (equation 8) or averse (equation 9) to incentives as follows:

$$\Delta^{-}U_i \mid_{S>0} = \int_t^{A+L_i} e^{-\rho \cdot t} \cdot \left[-b \cdot s^{\Omega} \cdot \left(g + u^{\beta}{}_j\right)\right] \cdot dt\,, \quad \forall \lambda > 0 \qquad (8)$$

$$\Delta^{-}U_i \mid_{S>0} = \int_t^{A+L_i} e^{-\rho \cdot t} \cdot \left[-b \cdot s^{\Omega} \cdot \left(g + u^{\beta}{}_j\right) + \lambda \cdot s^{\Omega}\right] \cdot dt, \quad \forall \lambda < 0 \qquad (9)$$

As the disutility for the individual who has aversion to incentives is higher than the disutility of incentives for the individual who has propensity to incentives, for the same quantity of incentive the individual who is averse has a stronger disutility. Therefore, the incentive that makes total utility equal to zero is smaller for the individual who has aversion to incentives. The same proof can be made for both individuals being averse to incentive, and for both individuals who are prone, in this case by showing the utility gains instead of disutility.

Proposition 2 is demonstrated as follows: the higher the value of *b* the higher the disutility of the incentive. For two individuals who show propensity or aversion to incentives, the disutility of the individual who has a higher value of *b* is higher, and therefore, the incentive that is going to tolerate as maximum will be smaller.

3. Empirical Work

3.1 The Questionnaire and Data collection

In a broader questionnaire on attitudes towards blood and living organ donations (see Cabasés, Errea; Working Paper, 2011) we include some questions on incentives for blood and living organ donations. The aim is to find the different perception that different groups of blood and living organ donors have concerning a list of incentives, monetary and non-monetary.

Data were collected in May-June 2010. Two different formats of the same questionnaire were distributed: a pen and pencil questionnaire to a selected population of 500 blood donors, (n_1=201 is the number of questionnaires finally recruited, representing the 40.2% of the initially contacted), and an online questionnaire to the population of 2000 members of the staff community at the Public University of Navarre (n_2=453) questionnaires finally recruited from the university population, around the 22%). We finally have a total of N=654 questionnaires recruited.

We mix monetary, non-monetary and monetary incentives in order to compare individuals' preferences for the different kinds of incentives. The aim is to explore the preferences over incentives for the different groups of blood living organ donors. All the individuals who participated in the questionnaire are asked to choose their agreement with the following incentives:

- Incentives for blood donations: Some Reward, Fiscal Deductions, University Credits for students, Monetary Payment, Priority in Health Care (HC), Social Recognition, Information on blood donations, and Blood Tests.
- Incentives for living organ donations: Some Reward, Money, Fiscal Deductions, Preference in Health Care, and Priority in the Waiting Lists (WL) for an organ in the future.

Individuals are asked to choose their level of agreement/disagreement with each of the incentives listed. Responses are recorded in a likert scale of 5 levels, for each of the incentives, that goes from "Completely Agree" to "Completely disagree". Individuals have also a NA (not answer) fifth choice.

3.2 Identification of Donor Groups

The questionnaire begins asking about personal information and health characteristics that allow us to classify individuals among groups of blood donors and living donors (according to their willingness to donate) and other socio-demographic characteristics such as age, education and other.

According to their responses to certain questions of the questionnaire, individuals are classified among the following groups of blood donors:

1. Regular blood donors: Individuals who declare donating blood regularly

2. Non-regular blood donors: Individuals who declare donating blood but not regularly.

3. Past donors: Individuals who declare having donated in the past, but who quitted donation

4. Refused donors: Individuals who declare never having donated blood before, because of health reasons

5. Potential donors: Individuals who declare never having donated blood, but for a reason which is different from health

6. Non-donors non-classifiable: Some individuals declare themselves to be non-donors, but did not specify their reason for not donating. These individuals we have no information to know if they should be considered potential or refused donors, and therefore they will be removed for the analysis.

Concerning living organ donations, a question on willingness to donate an organ in life to a relative helps to classify individuals in this aspect. We distinguish four groups

of individuals, according their willingness to donate an organ in life to a relative: those who report to agree completely on being willing to donate (Maximum Willingness to donate or Max WTD), those who agree but not completely on being willing to donate (Mid WTD), those who disagree somewhat or completely on being willing to donate (Low WTD), and those who do not answer to that question (NA)

4. Results

4.1 Descriptive Results

Among the five groups of blood donors identified we observe the following distribution: Regular (35.94%), Non-Regular (10.6%), Past donors (8.6%), Potential (22.12%), and Refused (13.36%). There are also some individuals (9.37%) who are not possible to classify among one of these groups.

Concerning living organ donations, the respective percentage that each group represents in the sample is 54.59% for Max WTD, 21.41% Mid WTD, 5.66% for Low WTD and 18.35% for those who do not answer.

The table below (Table 1) shows the distribution of responses for each of the incentives by groups of blood donors. We observe that, in general, individuals disagree on receiving some reward as a compensation for blood donations. However, there are some differences between the distributions of responses depending on the kind of incentive proposed. It can be said, according to the results observed, that non-monetary incentives are better accepted than monetary incentives.

Analyzing the responses of each group of blood donors we observe that: Regular donors disagree more than they agree in proportion on fiscal deductions, money, social recognition and statistics on blood donations, while they agree on the idea of offering priority in health care to blood donors and free blood tests. Non-Regular donors agree more than they disagree on the idea of offering fiscal deductions, but for the rest of incentives they are more in disagreement than they are in agreement. Past donors disagree more than they agree on the idea of offering any kind of reward, but in this case, past donors disagree somewhat and not completely. Potential donors do not know what to answer concerning fiscal deductions, social recognition. They agree more than disagree on the idea of offering priority in health care to blood donors, and disagree more than they agree on the idea of offering social recognition, statistics on blood donations and blood tests. Refused donors disagree more than they agree on the idea of

offering fiscal deductions, but agree more than disagree on rewarding blood donors with money, priority in health care, statistics on blood donations and blood tests.

Table 1. Responses to questions on Incentives by groups of blood donors

Incentive	N	% Regular	% Non-Regular	% Past	% Potential	% Refused	% Non-Donor (unclassifiable)
Some Reward							
Completely Agree	74	29.73	9.46	6.76	36.49	17.57	0.00
Somewhat Agree	148	40.14	6.80	6.80	29.25	16.33	0.68
Somewhat Disagree	98	36.08	13.40	10.31	24.74	14.43	1.03
Completely Disagree	215	45.58	13.02	8.84	14.88	15.81	1.86
Does not know	18	27.78	0.00	11.11	55.56	5.56	0.00
Missing	101	15.00	11.00	10.00	8.00	1.00	55.00
Fiscal Deductions							
Completely Agree	61	39.34	11.48	8.20	29.51	9.84	1.64
Somewhat Agree	99	34.34	14.14	8.08	26.26	17.17	0.00
Somewhat Disagree	98	45.36	9.28	5.15	29.90	10.31	0.00
Completely Disagree	269	39.18	10.07	10.07	20.52	18.28	1.87
Does not know	22	40.91	4.55	4.55	31.82	18.18	0.00
Missing	105	17.31	10.58	9.62	8.65	0.96	52.88
Money							
Completely Agree	35	8.57	2.86	2.86	57.14	28.57	0.00
Somewhat Agree	67	11.94	2.99	1.49	55.22	28.36	0.00
Somewhat Disagree	57	31.58	8.77	5.26	40.35	14.04	0.00
Completely Disagree	377	49.07	13.07	10.67	13.07	12.80	1.33
Does not know	10	30.00	10.00	10.00	50.00	0.00	0.00
Missing	108	16.82	10.28	9.35	9.35	1.87	52.34
Priority in Health Care							
Completely Agree	117	35.90	6.84	6.84	33.33	17.09	0.00
Somewhat Agree	142	43.66	11.27	5.63	25.35	14.08	0.00
Somewhat Disagree	66	39.39	13.64	7.58	24.24	15.15	0.00
Completely Disagree	209	39.13	11.11	11.59	19.81	15.94	2.42
Does not know	12	33.33	16.67	0.00	25.00	25.00	0.00
Missing	108	17.76	10.28	10.28	8.41	0.93	52.34
Social Recognition							
Completely Agree	141	40.00	7.14	5.71	27.86	17.86	1.43
Somewhat Agree	168	35.93	12.57	8.98	23.95	17.96	0.60
Somewhat Disagree	81	28.75	15.00	10.00	25.00	18.75	2.50
Completely Disagree	140	48.57	10.71	7.86	21.43	11.43	0.00
Does not know	18	44.44	0.00	16.67	38.89	0.00	0.00
Missing	106	17.92	10.38	10.38	7.55	0.94	52.83
Statistic on Blood donations							
Completely Agree	317	38.29	8.86	9.49	24.05	18.35	0.95
Somewhat Agree	172	39.18	12.28	7.60	25.15	15.20	0.58
Somewhat Disagree	19	31.58	21.05	10.53	36.84	0.00	0.00
Completely Disagree	21	42.86	19.05	4.76	28.57	4.76	0.00
Does not know	18	61.11	5.56	0.00	22.22	5.56	5.56
Missing	107	18.87	10.38	9.43	7.55	0.94	52.83
Free Blood tests							
Completely Agree	317	46.68	10.71	7.65	20.41	13.78	0.77
Somewhat Agree	172	26.45	7.44	9.92	33.88	22.31	0.00
Somewhat Disagree	19	20.00	30.00	10.00	40.00	0.00	0.00
Completely Disagree	21	16.67	16.67	5.56	44.44	5.56	11.11
Does not know	18	16.67	8.33	16.67	25.00	33.33	0.00
Missing	107	12.24	11.22	10.20	8.16	1.02	57.14
Total	**654**	**35.94**	**10.6**	**8.6**	**22.12**	**13.36**	**9.37**

Looking at the preferences towards incentives for living organ donations (Table 2) we observe the following results: Individuals reporting Maximum WTD agree more

than they disagree on the idea of rewarding living organ donors with money and priority in health care, while disagree more than agree on the idea of offering preference in the waiting lists to living organ donors. Individuals with weak WTD disagree more than agree on the idea of rewarding living organ donors with monetary incentives such as money and fiscal deductions, and also disagree on the idea of offering priority in health care to living organ donors, but agree more than disagree on the idea of offering preference in the waiting lists. Individuals with low WTD do not show their preferences with each kind of incentive, choosing in general the "does not know" response.

Table 2. Responses to questions on Incentives by groups of living organ donors

Incentive	N	Max WTD	Mid WTD	Low WTD	NA
Some Reward					
Completely Agree	163	63.19	27.61	8.59	0.61
Somewhat Agree	144	65.97	28.47	4.86	0.69
Somewhat Disagree	73	67.12	28.77	4.11	0.00
Completely Disagree	131	70.23	22.14	5.34	2.29
Does not know	14	50.00	21.43	28.57	0.00
Missing	129	8.53	0.78	1.55	89.15
Fiscal Deductions					
Completely Agree	75	68.00	25.33	5.33	1.33
Somewhat Agree	90	70.00	25.56	4.44	0.00
Somewhat Disagree	84	66.67	30.95	2.38	0.00
Completely Disagree	247	66.40	24.29	8.10	1.21
Does not know	26	50.00	26.92	19.23	3.85
Missing	132	7.58	3.79	1.52	87.12
Money					
Completely Agree	30	60.00	33.33	6.67	0.00
Somewhat Agree	49	71.43	20.41	8.16	0.00
Somewhat Disagree	88	67.77	31.82	2.27	1.14
Completely Disagree	335	67.16	24.78	7.16	0.90
Does not know	20	55.00	25.00	15.00	5.00
Missing	132	8.33	3.03	1.52	87.12
Preference WL					
Completely Agree	178	59.55	32.02	7.30	1.12
Somewhat Agree	140	68.57	25.00	6.43	0.00
Somewhat Disagree	56	73.21	25.00	0.00	1.79
Completely Disagree	138	71.01	20.29	6.52	2.17
Does not know	16	62.50	12.80	25.00	0.00
Missing	126	4.76	3.17	1.59	90.49
Priority in Health Care					
Completely Agree	67	73.13	25.37	1.49	0.00
Somewhat Agree	94	65.96	26.60	6.38	1.06
Somewhat Disagree	108	59.26	37.04	3.70	0.00
Completely Disagree	227	68.28	22.03	7.93	1.76
Does not know	26	65.38	15.38	19.23	0.00
Missing	132	7.58	3.03	2.27	87.12
Total	**654**	**54.59**	**21.41**	**5.66**	**18.35**

4.2 Regression Results

We estimate probit models. The probit model is expressed as:

$$\Pr(y_i \neq 0 \mid x_j) = \phi(x_i \beta)$$

where ϕ is the standard cumulative normal, y_i is a discrete dependent variable that we want to explain, and x_i are the independent variables. In our case, our dependent variables are binary, representing each of the groups of donors, so that $y_i=1$ if the individual belongs to the group of interest and 0 otherwise. Our independent variables are the levels of agreement/disagreement with each of the incentives.

We therefore estimate the variations on the probability of being of a certain group associated to each level of agreement for each of the incentives proposed (that is, the marginal effect).

The results are shown in tables 3 and 4 below, Table 3 showing the results for each of the blood donors' groups, and Table 4 showing the results for groups of individuals according to their willingness to donate living organs.

Refused, past and non-donors by unknown reasons are removed for the analysis of incentives on blood donations. We observe that not agreeing completely with fiscal deductions or blood tests decreases the probability of being active donor. More precisely, the more the individual disagrees with fiscal deductions the stronger is the impact on the probability, with a reduction of the probability of being an active donor of 0.26 if the individual completely disagrees. Disagreeing completely on the idea of offering blood tests decreases the probability of being active donor in 0.25. Complete disagreement with monetary incentives increases the probability of being an active donor in 0.77. Our estimates show that none of this kind of incentives would be effective on crowding-in of potential blood donors, while it can be said that money would crowd-out active donors.

Comparing active and past donors (the difference with the previous model is the inclusion of past donors in that model) we observe the following results. Results are very similar, with some slightly differences on the magnitude of the marginal effects, which are a bit smaller. Doing the difference between the marginal effects of both models we get the impact over the probability of being a past donor. For example, completely disagreeing with fiscal deductions decreases the probability of being a blood donor in 0.231, and in 0.260 of being an active donor. Therefore, by difference, we

obtain than disagreement with fiscal deductions increases the probability of being a past donor in 0.029.

The last estimation compares regular and non-regular donors. All the non-donors have been removed for the estimation of this model. Results show that disagreeing with blood tests and social recognition decrease the probability of being a regular donor in 0.232 and 0.4 respectively.

Table 3. Probit Model Results I (dy/dx: marginal effects). Incentives for blood donations

Incentive	**Active vs Potential**	**All Blood Donors vs Potential**	**Regular vs Non-Regular**
Some Reward	**dy/dx**	**dy/dx**	**dy/dx**
Somewhat Agree	0.020	0.012	0.224
Somewhat Disagree	-0.023	-0.037	0.082
Completely Disagree	0.076	0.035	0.068
Does not know	-0.347*	-0.164	(empty)
Fiscal Deductions			
Somewhat Agree	-0.122**	-0.108**	-0.032
Somewhat Disagree	-0.145***	-0.144***	0.177
Completely Disagree	-0.260***	-0.231***	0.150
Does not know	-0.051	-0.186	0.157
Money			
Somewhat Agree	0.093	0.085	-0.029
Somewhat Disagree	0.354***	0.377***	-0.039
Completely Disagree	0.771***	0.774***	-0.078
Does not know	0.441**	0.429**	-0.316
Priority			
Somewhat Agree	-0.036	-0.019	-0.051
Somewhat Disagree	-0.014	0.009	-0.085
Completely Disagree	-0.083	-0.030	-0.009
Does not know	0.002	0.003	-0.223
Social Recognition			
Somewhat Agree	0.011	0.024	-0.144**
Somewhat Disagree	0.050	0.050	-0.232**
Completely Disagree	0.026	0.022	-0.001
Does not know	-0.126	0.036	(empty)
Statistics on Blood donations			
Somewhat Agree	0.079*	0.059	-0.015
Somewhat Disagree	0.054	0.025	-0.187
Completely Disagree	0.039	0.016	-0.169
Does not know	0.239***	0.172**	0.101
Blood Tests			
Somewhat Agree	-0.215***	-0.178***	-0.015
Somewhat Disagree	-0.189	-0.130	-0.444**
Completely Disagree	-0.256**	-0.253**	-0.417**
Does not know	-0.423**	-0.226	-0.155
N	**398**	**443**	**257**
Log likelihood ratio	**166.83**	**164.17**	**32.59**
Pseudo R2	**0.3508**	**0.305**	**0.118**

Table 4 shows the result of the estimation of a probit model in which the dependent variable takes value 1 if the individual completely agrees on being willing to donate an

organ in life and 0 otherwise. We remove all the individuals who did not answer that question and estimate the marginal effects of each level of agreement, with each of the incentives, over the probability of being completely willing to donate living organs.

Results show that the more individuals disagree on the idea of offering preference in the waiting lists for living organ donors, the more the probability of being willing to donate increases. We could therefore say that this kind of incentives would crowd-out individuals who declare being willing to donate. Another significant effect is observed for priority in health care incentive. In this case, disagreeing with that incentive decreases the probability of being willing to donate, and therefore increases the probability of being of the group that reports the lowest degree of willingness to donate. This could be interpreted as follows: there will be more individuals who would not consider appropriate an incentive such as priority in health care than the contrary among those who have lower levels of willingness to donate. Therefore, this kind of incentive will not be effective, according to our results, for crowding-in individuals with lower willingness to donate.

Table 4. Probit Model Results II. (dy/dx: marginal effects). Incentives for living organ donations

	Max WTD vs Mid-Low WTD
Variable	dy/dx
Some reward	
Somewhat Agree	0.011
Somewhat Disagree	0.021
Completely Disagree	0.049
Does not know	-0.149
Fiscal deductions	
Some reward	-0.013
Somewhat Agree	-0.059
Somewhat Disagree	-0.082
Completely Disagree	-0.153
Does not know	
Money	
Somewhat Agree	0.154
Somewhat Disagree	0.082
Completely Disagree	0.113
Does not know	0.125
Preference in Waiting Lists	
Somewhat Agree	0.166***
Somewhat Disagree	0.243***
Completely Disagree	0.202***
Does not know	0.141
Priority in health care	
Somewhat Agree	-0.112
Somewhat Disagree	-0.222***
Completely Disagree	-0.166**
Does not know	-0.090
N	**513**
Log Likelihood ratio	**25.22**
Pseudo R2	**0.038**

5. Discussion

The economic model for the decision of becoming or not a donor is general for both kinds of donations considered in this paper (blood and living organ donations). This does not avoid that the values for the arguments in the utility function differ depending on the decision context is donating blood or an organ in life: for example, the value for the expected costs will be, in general, higher when the individual is thinking about donating an organ. We think that the arguments included describe well the decision making process in the two contexts: there should be a per-se benefit, an expectation of well-being due to the expected improvement in the recipient, unknown in the case of blood donations, and possibly very different in magnitude to that of donating an organ to a relative, and some expectation of costs (in terms of health, time dedicated to the donation process, or other). We consider a specific hypothetical situation in which some compensation is offered for donating. Therefore, incentives are also an argument of the utility function, influencing individuals' final decision. Incentives affect the selfish and altruistic parts of the utility. The total effect of the incentive over utility depends on the weight that the individual gives to the impact of incentives to the degree of altruism and self-interest. However, as we said before, incentives are one of many other arguments influencing the final decision. Therefore, even the result of introducing incentives is negative (a decrease in utility) the individual may decide to become a donor for other reasons (high per-se benefit, high expectations of improvement for the recipient…).

In a previous paper on attitudes towards blood and living organ donations we confirmed the influence of expected benefits and costs of blood and living organ donations, showing that there are differences in the expectation of costs, per-se and other-regarding benefits between groups of blood and living organ donors. In this chapter we analyze the difference between groups of donors in the level of agreement and disagreement with a list of incentives, some of them monetary and some of them non-monetary. The incentives are hypothetical, so that they were not evaluating real incentives. Responses, therefore, should be interpreted as how happy an individual would be with each of the incentives, if applied.

Our results are descriptive but could be a clue for policy making. Relating the degree of agreement and disagreement with incentives to the fact of being a blood/non-blood donor, or to the degree of willingness to donate an organ, we observe which

incentives could be more attractive for the different groups of blood donors, and for individuals with a stronger or weaker willingness to donate. We consider that this information should be contrasted (field experiment), but could be a clue of which incentives would be more likely to crowd-in new donors and also to identify the incentives with higher risk of crowding-out donors.

6. Concluding Remarks

This paper explores how individuals' decision may be influenced by external interventions. Individuals' preferences may not be stable, but may change, essentially depending on the effects of external interventions over individuals' degree of altruism and self-interest. The theoretical model analyzes the effect of introducing incentives into the utility function when individuals are impurely altruistic. We show that crowding-out of offering incentives occurs when the negative impact of incentives over the degree of altruism is stronger than the positive impact of incentives over self-interested utility. However, there can also be a crowding-in effect, so that individuals could be attracted by incentives when the negative impact over the altruistic part of the utility is weaker than the positive impact over the self-interested utility. The difference between these two effects determines the total effect for each quantity of the incentive offered. The main result, and contribution, of this model is that each individual has a different willingness to accept a different compensation, depending on his or her propensity or aversion to receive incentives. A limitation is that, in practice, it is impossible to individualize the incentives, offering a different compensation for each individual. However, having knowledge about the willingness to accept different incentives in a certain society, could be helpful for a social planner to decide which incentive would be the best incentive in terms of the number of individuals attracted (crowding-in) versus the number of individuals dissuaded (crowding-out).

The questionnaire allows calculating the variation on the probabilities of being of different groups for the different levels of agreement/disagreement on each incentive. We conclude that donation policies should be focused on non-monetary incentives rather than on monetary payments as the later imply a higher risk of losing active donors.

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3

The influence of altruism, socio-economic status and health on blood donation behavior in the French population

María Errea, Nicolas Sirven, Thierry Rochereau

The influence of Altruism, Socio-Economic status and Health on blood donation behavior in the French population

María Errea, Nicolas Sirven, Thierry Rochereau

Abstract

In France, the supply of blood is rare: each year, only 4-5 % of the population donates blood. Yet, according to the French Blood Establishment (EFS), there is no shortage, the demand for blood being fully covered. Nevertheless, the stock of donors continues fluctuating, some individuals interrupting their donation because of their age, health problems or other reasons. The problem then is how to not collect the blood beyond the application to not have to destroy. The objective of this article is to analyze the determinants of blood donation in the French population in age and ability to make this donation distinguishing active donors from potential donors. Data from the Health and Social Protection Survey (ESPS) 2012 are used. We test the hypothesis that altruism, socioeconomic characteristics, and health, are important determinants of blood donation. Our results show that active donors are more altruistic than potential donors, declare higher levels of social capital, and are more risk-takers. In addition, the absence of a degree seems to be reducing the likelihood of individuals resigning to donate. There is also an age effect found among men, the older donors being more likely to be active donors than the younger. Given that the 2012 ESPS survey is the primary source of data in the general population to combine socio-economic, demographic and health characteristics with questions about blood donation we conclude this new information on the behavior of donors could be of great interest for the development of public policies to promote blood donation.

1. Introduction

The supply of blood is rare, only 4-5 % of the French population actually give blood each year, about 3 million units of blood collected per year according to the latest statistics published by the World Health Organization (WHO, 2013). Yet, according to the French Blood Transfusion Center (EFS), there is no shortage in France, the demand being fully covered thanks to the constant efforts of the EFS one of the main tasks being to manage the blood supply according to its demand.

However, the need for blood is still ongoing. Increasing the supply of blood collected remains indispensable. The stock of donors continues fluctuating, some interrupting their gift either because of their age (the population in France is aging, which could cause problems in the future), health problems or other reasons. Safety requirements of institutions responsible for the collection of blood have also significantly increased with time, especially after the scandal of contaminated blood in the 80s that streaked several countries, including France. During this scandal one over two patients with hemophilia had been contaminated by the virus HIV / AIDS (Casteret, 1992; Chauveau, 2011). The real problem was the failure of the French health system at the time, not using existing methods of heating certain blood products, extracted from plasma, capable of inactivating the virus in donated and contaminated blood. The expansion of this virus among individuals transfused blood from one of these contaminated units has resulted in an increasing lack of trust of individuals in the health care system, including the system of blood donation. Since then, it can be said that blood donation could be perceived by individuals as an activity which involves a certain risk.

The French Blood Establishment (EFS) also reported the problem that for some blood types the demand is sometimes difficult to cover. Attracting universal blood donors (O^- type) has become a priority in order to cover this gap, being this type especial as blood type O^- transfusion can be made to individuals of any other blood types. The EFS considers the total of men who give blood number has not fully reached its potential. For this, the EFS seek to increase donors among the men population. The main reason is to compensate the temporary loss of women quitting donation after childbirth. Blood obtained from postpartum women may be less pure risking of being of lower quality, and therefore increasing the proportion of men donating would be a

solution to cancel this risk and cover this gap.

There are reasons to believe that the supply of blood may decrease in the near future. Furthermore, from the viewpoint of the mechanisms of incentives new donors, there is a conflict: on the one hand, the blood collection cannot be performed beyond its demand to not having to destroy. We must be vigilant about the incentive mechanisms to avoid having a much higher supply and demand of a good that is not easy to conserve. On the other hand, we must not neglect incentive mechanisms in order to prevent a sudden rationing situation of blood supply.

The problem is to find a mechanism to effectively manage blood supply. Unlike other goods, the blood is a non-pecuniary good, meaning that price mechanisms cannot be used to increase the blood collected. According to economic theory, the only way to increase the supply of this kind of goods would be to reduce the opportunity costs of the suppliers. The problem in France is based on the need to raise awareness of the importance of donating blood. Although today there is no actually a rationing problem, this optimal situation may not be able to continue in the future. Researchers in economics and social sciences in general are seeking mechanisms to increase the supply of blood, a good that is rare, and with the special characteristic of impossibility of introducing price mechanisms to manage it. Efforts to better know the populations of blood and non-blood donors are therefore necessary, in order to be able to design policies that would fit populations' interests and at the same time would be effective on encouraging blood donations.

The objective of this article is to analyze the determinants of blood donation in the French population. The analysis focuses on measuring the influence of altruism, socio-economic characteristics and health factors on different blood donors' profiles. For the analyses, the population is constrained to individuals who are in age of donating and who don't have health restrictions for donating blood.

Despite the importance of this issue, few studies are concerned in France about the research of incentive mechanisms for encouraging blood donation. Some data from survey studies to the general population are available (EFS, CREDOC, 2007), but the 2012 Health and Social Protection Survey (ESPS) 2012 is the primary source of data in the general population to combine questions on socio-economic, demographic and health conditions with questions about blood donation in France.

In this paper, the determinants of blood donation are identified among the population age give and has no health problems. The influence of the three principal

determinants on blood donation is tested among the population in age of giving, comparing the population of active donors and potential donors: variables of individual behavior (altruism, social capital, and risk aversion), socio-economic characteristics (income, occupation, education, occupation), and health factors. Hopefully, this additional information could be of great interest for the development of public policies on the promotion blood donation.

1.1 Behavioral variables and blood donations

Blood donation is voluntary and altruistic. According to the first definition of altruism, Comte, altruistic individuals are willing to make a personal sacrifice to increase the well-being of others. Later, Andreoni (1990) proposed the existence of two types of altruism. According to Andreoni, some individuals are altruistic and selfish at the same time, having a personal interest to behave altruistically. According to the hypothesis of the existence of impure altruism, some individuals do not give only to improve the well-being of others, but also because the act of giving makes them happy or refers to other image of a generous and selfless person. Today, evidenced by the evidence shows the existence of impure altruism (Crumpler, Grosmann, 2008) and the personal benefit of the gift is conceptualized under the term "warm-glow". Studies have also shown that impure altruism is also a good predictor of blood donation (Evans, Ferguson, 2014).

The literature also shows a relationship between the fact of belonging to associations following a collective interest and altruistic behavior. According to Becker and Murphy (2000) individual behavior may be dictated by the "tyranny of social forces", that is to say that the average behavior of a particular social group acts as a standard around which the behavior of the members of the social group complies. The authors call this effect "the social multiplier". The individuals' stock of social would have an influence on their behavior and, in particular, on blood donation behaviour. For Macinko and Starfield (2001), the central thesis of social capital is that participation in community life, such as the decision of individuals of becoming members of social groups, induces the creation of a formal identity through the sharing of norms, beliefs and priority values. Kawachi and Berkman (1998) analyze the effect of associations at district and state levels. They show that neighborhood associations, if they are strong (which indicates a high level of social capital) can influence (1) behaviors related to health promotion, thus increasing the likelihood that standards are adopted for healthy

behaviors and exercise social control over deviant health, and (2) ensuring that budget cuts do not affect the provision of local services for that society. The most cohesive states would be more effective on the production of more egalitarian models in terms of political participation, such as those that ensure the safety of all their members, which would have a positive impact on health. Studies show a positive relationship between social capital and blood donation. Veenstra (2000) shows that individuals subject to social norms as a result of belonging to an association which pursues a specific collective interest have a higher probability of donating blood. Similarly, other studies (Putnam, 2000; Kolins and Herron, 2003) showed empirical evidence of a decline in blood donations in the United States that could be attributed to a decline in the level of social capital. Alessandrini (2007) also observed that the proportion of donors (active or past) involved in non-governmental organizations (NGOs) is higher than that of non-donors. These results reinforce the argument that blood donation is considered a similar voluntary action that it is an altruistic action.

Concerning the perceived risk of donating blood, it does not seem enough studies on the relationship between these variables and blood donation. An additional contribution of this work will be to test the idea that there may be.

1.2 Socio-economic characteristics and blood donation

Studies have been published on the research of socio-economic profile of donors and non-donors. Differences have been found in different populations between donors and non-donors according to the educational level, income and employment. Greinacher et al (2010) found in a study in Germany that the probability of being a non-donor is reduced for individuals who reported higher levels of education and income, and who live in less urbanized residential areas. The authors also show that men give blood more frequently than women, and men who live in urban areas give especially regularly while occasional donors would be more concentrated in the less urbanized areas. Veldhuizen *et al* (2009) show in a study population in Holland, how individuals with higher levels of income and living in the less urbanized areas have a lower risk of quitting blood donation compared to individuals with higher income levels. Alessandrini (2007) also shows a positive relationship between education level and the probability of donating blood. Specifically, individuals with higher levels of education would be significantly more sensitive to this type of behavior.

1.3 Health factors and blood donation

The literature provides studies that show that people who participate in the voluntary are more likely to declare a good perception of the level of physical and mental health (Borgonovi, 2008). However, feeling healthy is not the same than being healthy, and some individuals may be refused to donate their blood because of health restrictions. Different countries have different criteria for blood donation, and these criteria are more and stricter with the time. However, there is the general feeling that individuals have very poor information about the donation criteria. In the case of France the decision of exclusion of individuals from blood donation is taken according to the 2009 EFS decree (« *Arrêté du 12 janvier 2009 fixant les critères de sélection des donneurs de sang* »).

In the next section we present our data source (the ESPS 2010) as well as assumptions regarding the determinants for blood donation considered. The sample and data on blood donation are described using descriptive statistics for the variables of interest and the explanatory factors of blood donation. The methods for analysis focus on identifying the profile of donors and non-donors in the population in age and ability to donate. Three groups of donors are identified and described: active donors (individuals who have donated blood at least once in their lives and have made at least one donation in the last twelve months), potential donors (who have never donated blood or who have quitted blood donation in the past twelve months without having, *a priori* and according to their responses to questions on health, health restrictions), and refused donors (who cannot give blood because of health problems or other reasons considered grounds for permanent exclusion according to the EFS criteria). Finally, we present the descriptive and regression results, and conclude.

2. Data source, Hypotheses and Variables description

2.1 Data source: The ESPS survey[1]

The ESPS survey interviews ordinary households, that is to say, the occupants of a private house. Collective households (institutions, residences...) and homeless people are not surveyed. The geographical scope is the metropolitan France. There are three samples from the ESPS survey: a sample of households, a sample of individuals and a

[1] The official questionnaires of the ESPS 2012 survey can be download from the IRDES website: http://www.irdes.fr/recherche/enquetes/esps-enquete-sur-la-sante-et-la-protection-sociale/questionnaires.html

sample of individuals who responded to the main questionnaire (only one individual is selected per household). To take into account the particularities of sampling and non-response, a weight is calculated for each of these three samples. It is based on the weight of initial surveys weighted by a timing margin to ensure a good representation of some key variables of interest (age, gender, household size and health insurance).

Two modalities of the ESPS survey, telephonic (CATI modality) and face-to-face (CAPI modality), were performed. In addition the questionnaire was administered in two different contacts. After the first contact in which individuals answered general questions on socio-economic and demographic characteristics, all the individuals aged over 15 received an additional paper questionnaire, which included in 2012 a module of questions on blood donation.

2.2 Hypotheses

Although altruism is assumed a general characteristic of blood donors, the level of altruism of each individual is different. In addition, people who do not donate blood can also be altruistic. Our hypothesis concerning altruism is that being willing to donate organs could be a good measure of pure altruism. When there is no benefit to donate organs after death, will make this gift can be considered as a purely altruistic behavior. Among individuals who would be ready to donate their organs we can distinguish those that have made a step in this direction (having signed the organ donor card or having communicated this desire to their relatives: question 54 of the questionnaire "15 and over"). The question on having a relative who was transfused (question 51 in the questionnaire "15 years and over") is also used as an indirect indicator of altruism. The hypothesis to test would be whether the current donors have a positive level of altruism and whether there are differences with the level of altruism of potential donors.

We also test the hypothesis of influence of social capital on blood donation. More precisely we assume that belonging to a social group (participation in associations for collective interests) could be a good proxy of the level of social capital of individuals, and we hypothesize that individuals belonging to associations have actually a higher probability of being active donors. The variable used to measure social capital is participation in collective activities in associations through the question: *"Do you participate regularly in group activities (meetings, events,…) in the context of an association (volunteer, parents, neighborhoods, parental nursery, union council building,...), a sports club, a religious community, a trade union, or a political party? ".*

Individuals who answered "yes" must specify in what capacity: as a manager (strong implication) or as a member.

Concerning risk aversion, given that blood donation can be perceived by individuals as an activity which involves some risk either for blood donors or recipients, our hypothesis is that active donors should be found to be more risk-takers that potential donors, who should declare themselves to be more risk averse. In the "Economic and social questionnaire module" included in the paper questionnaire for the population aged 15 and over, the following question is included as a measure for risk aversion: "*In terms of attitude towards risk, go with d a cross on a scale of 0 (very conservative) to 10 (adventurous) in different areas of life"*. Risk aversion is measured on a scale of 0 to 10, where 0 represents "very conservative" and yet more risk averse and 10 for risk-takers, that is people "more attracted by the adventure".

We will test the differences between active and potential donors based on the following socioeconomic variables: education, income, occupation and profession. Our results will be contrasted with the results shown in the literature, that is to say, a positive influence on the probability of donating for individuals according to their levels of education, income, occupation, and differences by occupation. The included variables are explained below:

• The educational level is classified into five categories in the questionnaire: No diploma, CEP / BEPC / CAP / BEP, Graduate and Other (when the level of education said is not classifiable in one of the categories mentioned). All individuals interviewed during the first contact responded to this question, which are mandatory to answer.

• Monthly income per consumption unit is obtained from the decomposition into income quintiles (five slices offered to respondents' income). The first quintile corresponds to 20% of the poorest population and the fifth to 20% of the richest population. A sixth category is created to integrate non-response.

• According to their occupation individuals can be classified into four categories: active, unemployed, retired and inactive.

• According to their profession individuals can be classified into 8 categories: Farmers, Artisans, Shopkeepers, Managers & associate professionals, administrative /clerical employees, employees of trade, skilled workers, and unskilled workers. Two categories are added for those who report having never worked (Inactive, never worked) and those who refuse to answer this question or with a declared profession is not classifiable in one of the categories described above will be considered into the category

"Unknown / Refused".

Finally, concerning health factors, we hypothesize that there should be a difference in the perception of health status between active and potential donors. The literature shows that donors, and generally, people who actively contribute to volunteering will report higher levels of perceived health. We will test whether this hypothesis can be verified in our population. To do this, first we need first to control by blood donation exclusion criteria and select those individuals reporting health problems which are a permanent exclusion pattern for blood donation (according to the EFS criteria). Once we have well selected the individuals who would never be able to donate, we compare active and potential donors according to their answers to two health related questions. Our health variables are:

• A variable of subjective health: The individuals' perception of health at the moment they answered to the ESPS questionnaire. The individual must choose the level of perceived health among four response categories: very good, good, poor, very poor.

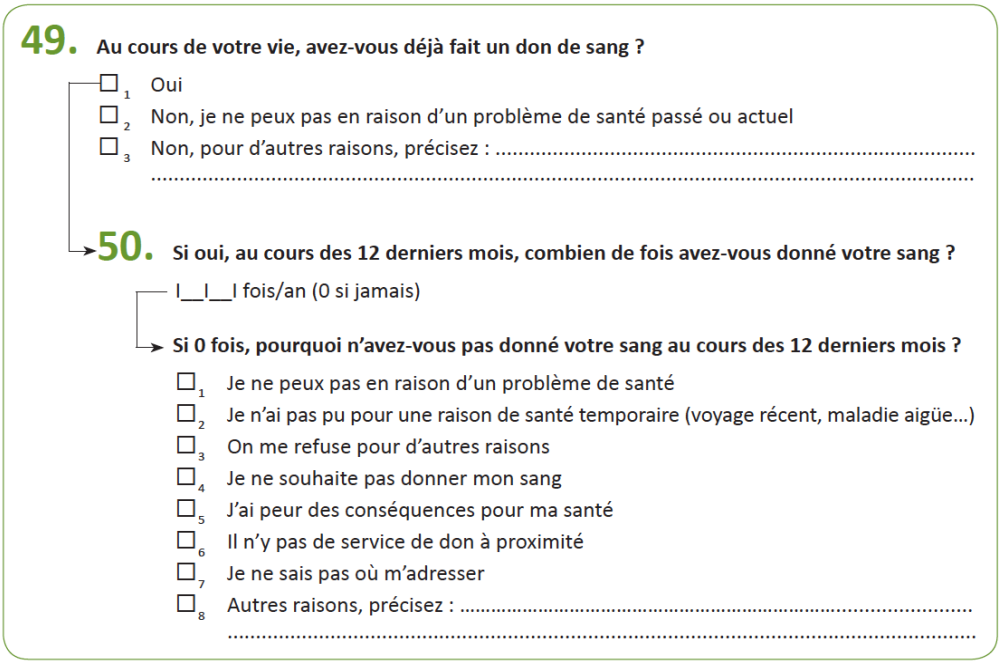
• A variable of objective health, whether the individual has experienced in his life a chronic or long-term disease, without the disease being specified. The answer is again categorical: yes, no, do not know.

The age, sex and residential area are control variables essential to be included in all the analysis. We will check if there is a different behavior on blood donation for different age groups, gender and residential area. Age, between 18 and 70 years, that is to say, the age population give blood, is classified into age ranges as follows: 18-29, 30-39, 40-49, 50-59 years, 60-70 years. Data on the residential area are context data. There are 4 residential areas: multi-polarized, rural, suburban ring, and urban cluster.

2.3 Construction of dependent variable: Blood donor profiles

Figure 1 shows the questions about blood donation included in the ESPS questionnaire. Figure 2 shows how we construct the different blood donor groups or profiles according to individuals' answers to the module on blood donation and some relevant health questions in the paper questionnaire for the population aged 15 and over.

Figure 1 : The Blood donation module



Three types of donors are identified. From now on we will distinguish between Active donors, Potential donors and Refused donors. According to individuals' responses, Active donors are individuals who have donated blood in the past twelve months. Potential donors are individuals who do not give blood but who could do so as they have no health problems restricting them from donation. Refused donors are individuals who do not give blood because of health problems that are reason for permanent exclusion for blood donation.

This category of refused donors includes:

• Individuals who have never donated blood because of a health reason (Question 49.2 in the module on blood donation checked).

• Individuals who have already donated ("yes" in question 49 of the blood donation module) but not in the last twelve months (specified "0 times / year " in question 50) for health reasons (Question 50.1 checked, and health reasons identified from responses to the open question 50.8).

• Individuals who declare having been transfused (identified in the open question for those who say they have received a transfusion) and those exceeding the age of donation.

• All individuals who report being in disorders of long duration (ALD), supported at 100% by the National Health Insurance are considered also disqualified for blood

donation.

• All individuals who reported over the last twelve months having experienced one of the following diseases: bronchitis, myocardial infarction, coronary artery disease, hypertension, stroke, diabetes and liver cirrhosis (question 8 of the questionnaire " 15 years and over"). These diseases are considered by the EFS as a permanent exclusion pattern for blood donation.

The identification of groups of donors is performed taking into account the reasons for exclusion imposed by the EFS. However, as some people may not be aware of these exclusion criteria and the ESPS survey on blood donation is self-administered and not filled by a physician, reporting bias may occur. In fact, among individuals who declare not to donate blood for reasons different than health reasons, the analysis of the open question finds health reasons that would be a reason for permanent exclusion from blood donation. Thanks to the open questions (49.3 Q and Q 50.8 , Figure 1), a large part of these individuals has been identified and switched to the group of refused donors, while according to their initial response they would have been part of the group of potential donors. A small part of the individuals choosing other reasons different from health did not specify the reason for not donating. These individuals will be therefore considered as potential donors, under the impossibility of knowing if their reason would be a reason for permanent exclusion. In the working sample however, among the 2,841 people who reported not to donate blood for a reason different from health problems, 2,535 responded to the open question. The answer to this question could not therefore be checked for only 306 individuals (7% of the respondents to question 49.3 did not specify the reason when requested). Similarly, the among the 1,306 people who declare having stopped donating blood in the last 12 months, 1,023 specify their reasons in the open question (Q 50.8, Figure 1). We can also identify individuals who report having quitted blood donation in the last twelve months due to permanent health reasons (switched to the group of refused donors), temporary health reasons (switched to the group of potential donors) and other reasons different from health (also switched to the group of potential donors).

A dozen of reasons have been identified among individuals' responses to the open questions about the reasons for not donating or for quitting donation: age, health reasons, permanent, temporary, have been transfused, supply problems (cf. Table 1), fear / discomfort you do not have confidence in the system of gift, do not wish to give justification / lack of motivation, lack of availability / time, and Others. Among these

reasons, some correspond to existing items of the initial questions (such as permanent and temporary health problems, not being willing to donate). Others may be new items to offer answers in future versions of the ESPS questionnaire. These responses are not exclusive, meaning that one individual can be classified into several categories if from the response of that individual many different reasons are identified. The following table presents the answers to open questions 49.3 and 50.8 of the paper questionnaire regarding reasons for not donating blood.

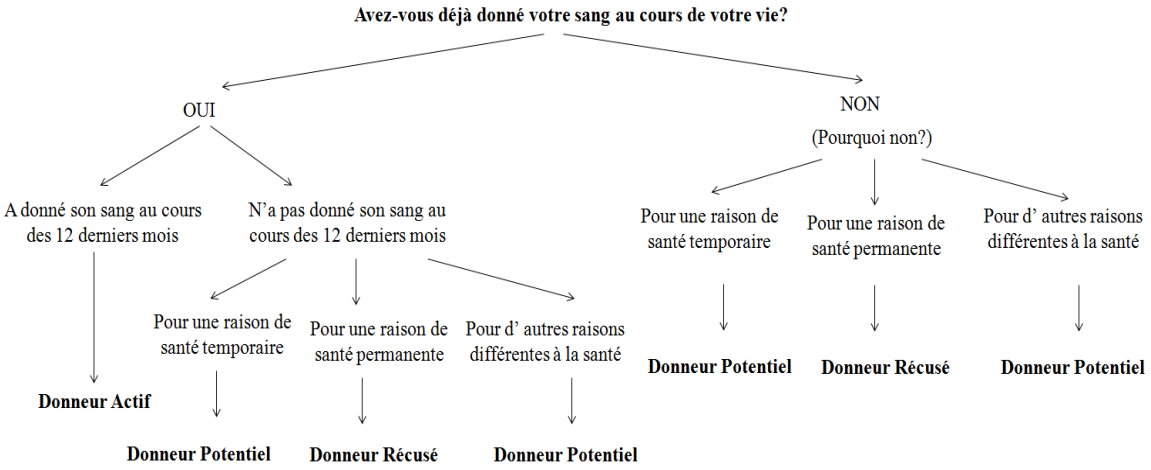
Table 1: Other reasons for not donating blood or for having quitted donating it

Reason	**Examples of Responses**	**Blood Donor classification**	**Has never donated**	**Has stopped donating blood in the last 12 months**
Age	Have exceed the age for donating blood	Refused	104 (3.97)	195 (17.60%)
Health reasons (for permanent exclusión)	Serious illness and blood diseases (hepatitis, leukemia,…)	Refused	227 (8.67%)	114 (10.29%)
Having been transfused	Ce n'est pas possible quand on a été transfusés	Refused	32 (1.22%)	16 (1.44%)
Health reasons (for temporary exclusión)	Weight <50 kgs, pregnancy, tatoos/piercings, trips to foreign countries, being in temporary medical treatment	Potential	172 (6.57%)	71 (6.41%)
Supply problems	Not enough information concerning blood donation, Extraction times are not convenient or incompatible with work time, impossibility of donating at the working place, Night workers	Potential	412 (15.74%)	156 (14.08%)
Fear/Discomfort	Has fear of needles or has had a bad experience donating blood in the past	Potential	501 (19.14%)	87 (7.85%)
Lack of trust in the Health Care System	Does not trust in the Health Care System	Potential	36 (1.38%)	9 (0.81%)
Does not wish to donate	I don't want to donate, this doesn't mean nothing to me	Potential	198 (7.57%)	12 (1.08%)
Excuses / Lack of motivation	Not motivated enough, Has not thought about it, Is not a regular habit of my daily life	Potential	425 (16.24%)	143 (12.91%)
Availability/Lack of time	Lack of time due to work, or just lack of time without specifying the time constraints	Potential	281 (10.74%)	263 (23.74%)
Other reasons	Reasons impossible to classify into one of the categories above	Potential	229 (8.75%)	42 (2.79%)
Total			**2617 (100%)**	**1108 (100%)**
Total Responses			**2535**	**1023**

Individuals who indicate a reason of age, permanent health or have been transfused donors are considered refused for blood donation. Individuals reporting any other

reason which is not a ground for permanent exclusion are considered to be potential donors. The most common responses made to these open questions are for people who have never given: "Fear / discomfort", "lack of motivation" and the "supply problems". For past donors, the main reasons to have quitted donation in the last twelve months are: "The lack of availability / lack of time", "Age" and "supply problems". Finally, the following diagram shows how the classification of donors made:

Figure 2. Diagram explaining the classification of blood donors into Active, Potential and refused.



This classification will be the one used for the descriptive and regression analyses presented below.

3. Descriptive Analysis

The ESPS 2012 sample consists of 23,048 individuals residents in France. In 2012, additional information was collected on the residential area of the interviewee and also on blood donation. Among them 69% of the individuals filled and give the paper questionnaire back (that is the questionnaire for the populations aged 15 and over). More questionnaires were lost in proportion for the telephone modality than for the face-to-face modality, the presence of the investigator therefore seems to have been crucial. Among respondents, 15,640 individuals are in age of donating (that is over 18 and under 70 years). Among individuals in age of donating, In the end 10,826 returned the paper questionnaire in which the module on blood donation was included, and 10

492 responded to questions about blood donation (67%), slightly more women (69%) than men (65%), fewer younger (61%) than older (74%). Three regions are significantly under-represented in the questionnaire "blood donation", the Ile de France (62.08%), Alsace (64.26%), and Alpes Méditérranées (64.18%).

The study population corresponds to people who responded to the paper questionnaire and missing responses are suppressed for the regression analysis. The sample used in the econometric model includes those individuals who responded to all the explanatory variables considered (behavioral variables, socio-economic characteristics and health conditions) in addition to the module on blood donation.

Table 2: Percentage of Delivered and Returned paper questionnaires for the population aged 15 and over. Initial and Working Samples

	Population Totale N= 23,048		**Population aged 18-70 N= 15,640**		**Working Sample N= 10,492**
Questionnaire Modality	**Delivered**	**Returned**	**Delivered**	**Returned**	**Questions in the Blood donation Module answered**
Telephone	11,787	6,584 (55.85%)	8,740	5,021 (57.44%)	4,898 (46,68 %)
Face-to-face	11,261	9,274 (82.25%)	6,900	5,805 (84.13%)	5,594 (53,31 %)

In the end, in our working sample the responses from CAPI and CATI modalities are balanced. Descriptive statistics are weighted to ensure the representativeness of the sample. This allows crossing variables from the blood donation module with the previously mentioned variables to better understand the population of interest and compare active donors with potential donors.

3.1 Descriptive statistics

To ensure an accurate description of the different blood donors' profiles, representative of the French population, statistics from the 2012 ESPS survey are weighted.

In Table 3, we notice that there are no significant differences between categories of donors in the sample, the ESPS data are weighted or not. Among the working sample of

10,492 individuals in age of donating blood who respond to the questions on blood donation, 6.48% are active donors, 40.28% are refused from donation and 53.24% are potential donors. These proportions are used for descriptive statistics that follow.

Table 3 : Working sample description. Effectives and Percentage of donors by groups

	Working Sample for descriptive statistics	**Working sample for regression analysis**
Donor groups	**ESPS Sample (weighted)**	**ESPS Sample (unweighted)**
Active Donors	680.25 (6,48%)	706 (6.73%)
Refused Donors	4,226.01 (40,28%)	4,118 (39.25%)
Potential Donors	5,585.73 (53,24%)	5,668 (54.02%)
Total	**10,492 (100%)**	**10,492 (100%)**

The proportion of active donors has been validated by the EFS, concluding that the difference in percentage of active donors in the French population (about 5% of the population donates in France) may be justified by the difficulties for respondents to remember with precision the last time they donate, so that the notion of "having donated in the last 12 months" may be an expandable concept for some individuals. In fact, the percentage of active donors in France in a time horizon of 18-24 months (instead of 12) approaches to 7%, much more similar to the percentage found in the ESPS questionnaire.

The EFS having validated our percentage of active donors, means that the assumption that individuals who have donated in the last 18 months consider themselves active donors, as if they have donated in the last twelve months is acceptable.

Table 4 shows the distribution of donor by groups according to control variables (age, sex) and the context variable "residential area". The results show that among active donors men outnumber women, the later being more frequently refused due to health reasons. Active donors are rather in the age group 30-49 years while refused donors generally belong to the elder categories. Most people responding in our working sample live in an urban area.

Table 4: Repartition of blood donors by groups according to age, sex and residential area

Variables	N	% Active	% Refused	% Potential		
				All Potential	Has not temporary health problems	Has temporary health problems
Sex						
Male	5063	7.05	36.08	56.87	55.79	1.07
Female	5429	5.98	43.98	50.04	48.54	1.50
Age						
[18-29]	2149	8.71	23.09	68.20	66.94	1.26
[30-39]	1789	7.08	24.95	67.98	65.89	2.09
[40-49]	2313	8.40	33.74	57.86	56.73	1.13
[50-59]	2187	5.98	51.33	42.69	41.47	1.23
[60-70]	2054	2.60	65.89	31.51	30.71	0.80
Residential Area						
Rural	2170	6.16	43.82	50.02	48.66	1.36
Suburban ring	2124	7.25	37.88	54.88	53.57	1.31
Multipolarized	600	8.59	37.89	53.52	52.39	1.13
Urban	5598	6.10	40.06	53.84	52.55	1.29
Total	**10492**	6.48	40.28	53.24	51.94	1.30

Source : ESPS 2012. Note: Statistics are weighted.

Table 5 shows the distribution of donors by groups according to behavioral variables (altruism, social capital and risk aversion are considered).

According to the results, 57.7% of the final working sample would be willing to donate their organs upon death. However, 30.4% did not know if they would be willing to do so, and 11.56% would definitely not be willing to do so. Active donors are more often inclined to agree than refused donors, the later being more in percentage not willing to donate their organs, and the proportion of potential who has doubts is found to be important.

The table also shows the percentage distribution of individuals of each group of donors, participating in group activities as part of an association of public interest. For active donors the percentage of participation is the highest compared to the other two donor groups, as well as they have highest percentage of participation as leaders of an association. Non-active donors (but not refused for health reasons) in the last twelve months are the second largest group in terms of participation. Refused donors who have never given due to health reasons, are those whose participation rate is the lowest among all the groups of donors. It can be seen that there is a relationship between being actively participate in group activities and blood donation.

Also differences are observed between donor groups for the highest levels of risk aversion (where potential donors with health problems are more likely than others, and

active donors are the least in percentage), for average levels (where potential donors with health problems are lesser in proportion and active and refused donors reach their maximum, without differences between them) and also for the lowest levels (where active donors are more in percentage than the rest of groups).

Table 5 : Indicateurs d'altruisme, capital social et aversion au risque

Variables	N	% Active	% Refused	% Potential		
				All Potential	Has no temporary health problems	Has temporary health problems
Willing to donate organs						
Yes	5783	8.33	39.64	52.03	50.24	1.78
No	1275	3.54	45.92	50.54	49.99	0.55
Don't know + Missing	3434	4.15	39.43	56.42	55.74	0.68
Has the organ donor card						
Yes	1869	11.37	36.90	51.73	48.60	3.14
No	3867	6.93	40.78	52.29	51.16	1.13
Missing	4756	3.95	41.32	54.74	54.10	0.64
Somebody close transfused						
Yes	1820	7.72	42.81	49.47	47.74	1.73
No	6241	7.25	35.25	57.50	56.04	1.46
Don't know + Missing	2431	3.74	50.62	45.64	45.04	0.60
Participates in associations						
Yes	3594	8.65	39.60	51.76	50.11	1.65
No	6703	5.39	40.34	54.27	53.14	1.13
Don't know + Missing	195	2.82	51.34	45.84	45.29	0.55
If « Yes»…						
Manager	1433	9.39	39.07	51.54	49.44	2.10
Member	2029	7.89	40.54	51.57	50.45	1.13
Missing	7030	5.46	40.45	54.09	52.91	1.19
Risk aversión level						
0 (Risk averse)	1030	3.92	49.55	46.53	46.32	0.22
1	636	5.33	46.10	48.57	47.11	1.45
2	1121	4.51	42.99	52.50	50.51	1.99
3	1249	6.28	39.96	53.76	52.52	1.23
4	990	6.37	39.61	54.02	52.34	1.68
5	2379	6.49	37.56	55.95	54.98	0.97
6	1017	8,67	38.61	52.72	51.06	1.66
7	935	7,37	33.07	59.56	57.23	2.33
8	558	9,45	35.71	54.85	53.65	1.19
9	154	13,15	27.61	59.24	58.91	0.33
10 (Risk taker)	133	11,71	43.31	44.98	44.98	0.00
Missing	290	5,71	52.33	41.96	41.59	0.37
Total	**10492**	6.48	40.28	53.24	51.94	1.30

Source : ESPS 2012. Note : Statistics are weighted

Table 6 shows the descriptive results according to socio-economic variables. Active donors have in general a higher level of education and higher incomes (mostly

represented in the fifth quintile). For the majority of refused donors we found they have no diploma and their income is equal or lower than the second quintile, being in general retired or inactive. Potential donors, meanwhile, tend to have a higher level of education, income above the third quintile, and are instead concentrated among the category of individuals who are employed.

Table 6: Distribution by groups of donors according to socio-economic variables

Variables	N	% Active	% Refused	% Potential		
				All Potential	Has no temporary health problems	Has temporary health problems
Education						
No diploma	1164	3.18	52.34	44.48	44.27	0.21
CEP/BEPC/CAP/BEP	3982	5.46	46.79	47.75	47.03	0.72
Bac	2741	6.47	34.69	58.84	57.36	1.48
Graduate	1559	9.10	31.74	59.15	56.00	3.16
Other	272	5.48	44.26	50.26	49.65	0.61
Students without diploma obtained	774	12.99	22.83	64.18	62.95	1.23
Income						
1st quintile	1592	5.23	44.98	49.79	49.37	0.42
2nd quintile	1638	6.64	42.95	50.41	49.56	0.85
3rd quintile	1747	5.69	40.55	53.76	52.32	1.44
4th quintile	1963	6.46	39.57	53.97	52.58	1.39
5th quintile	2094	8.26	36.23	55.51	53.50	2.01
Unknown/Missing	1458	5.85	39.38	54.77	53.50	1.27
Occupation						
Active	6167	7.88	31.41	60.70	59.13	1.58
Retired	1714	2.48	66.21	31.31	30.48	0.83
Unemployed	973	4.62	40.82	54.56	53.73	0.83
Inactive	1630	6.69	46.18	47.13	46.19	0.95
Other	8	0.00	50.24	49.76	49.76	0.00
Profession						
Farmers	1338	8.75	32.55	58.70	57.79	0.91
Artisans	501	3.95	41.27	54.78	54.30	0.47
Intellectual Profesion	1379	7.46	35.55	56.99	54.69	2.30
Intermediate Profesion	1885	7.39	39.27	53.34	51.24	2.09
Clerical	1501	5.90	44.45	49.65	47.93	1.72
Traders	1388	5.05	44.67	50.28	49.64	0.64
Qualified workers	1625	6.88	42.75	50.38	49.87	0.51
Unqualified workers	864	4.17	39.08	56.74	56.31	0.43
Inactive (never worked)	1	0.00	0.00	100.00	100.00	0.00
Unknown/Refuses to answer	10	6.47	40.61	52.93	52.93	0.00
Total	**10492**	6.48	40.28	53.24	51.94	1.30

Source : ESPS 2012. Note : Statistics are weighted

Table 7 shows how most individuals declare to be in very good or good health. Among those who report poor/very poor health, we can emphasize the small percentage

of active donors, while most of the people in poor health are refused and potential donors who have declared having a temporary health problem. Concerning the variable of objective health about 30% of respondents report having experienced a chronic illness or long-term disease. Among these individuals, active donors are the lowest group in percentage observed, and the largest percentage is for refused donors. In contrast, the percentage of active donors and potential donors is higher among those respondents who do not have a chronic illness.

Table 7. Distribution by groups of donors according to health variables

Variables	N	% Active	% Refused	% Potential		
				All potential	Has no temporary health problems	Has temporary health problems
Subjective Health						
Very good/good	9865	6.86	37.34	55.80	54.43	1.36
Bad/Very bad	566	0.78	88.66	10.55	10.37	0.19
Missing	61	1.03	43.26	55.71	54.08	1.63
Has experienced a chronic illness						
Yes	3312	3.09	72.63	24.28	23.45	0.83
No/Do not know	7080	8.24	24.16	67.60	66.05	1.55
Missing	100	1.03	46.69	52.28	52.28	0.00
Total	**10492**	6.48	40.28	53.24	51.94	1.30

Source : ESPS 2012. Note : Statistics are weighted.

4. Methods: Probit and Heckman selection models

A standard probit model and a Heckman selection probit model are estimated. The general expression for the probit model is:

$$Y = \Phi(x) \qquad (1)$$

Where Φ is the inverse of the distribution function (cumulative density function), Y is the outcome of interest that we want to explain and x the set of explanatory variables.

In our particular analysis, Y is a binary variable, taking two possible values {0, 1}, the 0 representing all the potential donors and 1 the active donors. We assume that this variable can be explained in part by the function $\Phi(x)$, where x are the determinants for blood donation considered in this paper and some control variables. Like any econometric model, there is an estimation error ε_i that is smaller the more we are able to explain Y.

The probit model with sample selection (Van de Ven and Van Pragg 1981) assumes that there is an underlying relationship such that:

$$Y^*_i = X_i \cdot \beta + \varepsilon_{1i} \quad (2)$$

Where (2) is the latent equation so that the outcome Y^* is not always observed. Instead, the dependent variable for observation "i" is observed if:

$$Y_i = Z_i \cdot \beta + \varepsilon_{2i} > 0 \quad (3)$$

Where (3) is the selection equation. The Heckman selection model assumes that the errors of the latent and selection equations follow a normal distribution such that $u_1 \sim N(0, 1)$ and $u_2 \sim N(0, 1)$, but also that there is a positive correlation between the two error terms, such that $corr\ (u_1, u_2) = \rho$. If the hypothesis of null correlation between the errors is rejected ($\rho \neq 0$), estimation using a standard probit will lead to biased results. The probit Heckman selection provides consistent estimates in the presence of positive correlation between the errors, asymptotically efficient for all parameters of the model. For the model to be well identified, the selection equation must have at least one variable that is not in the equation of the standard probit model. Otherwise, the model would be identified only by the functional form, and the coefficients will not have the correct structural interpretation.

The dependent variable of the selection model (Y_i in equation 3) is a binary variable. It takes value 1 if the individual is not a refused donor and 0 if it is a refused donor. We can see that actually the dependent variable of the latent equation (Y_i*) which only considers active donors and potential donors, is observed only when the selection variable is equal to 1 ($Y_i = 1$ if the individual is an active or potential donor), and it is not observed when $Y_i = 0$ (if the individual is a refused donor). The additional required explanatory variables chosen for our model selection are health variables, to see that the selection of the population of refused donors is correct.

5. Regression results

The standard probit model provides an estimate of the profiles of active donors (dependent variable = 1) and potential (0). In this model, refused donors are excluded in order two populations a priory in equality of health conditions for donating blood. Neither active donors nor potential donors included in the model have health problems according the grounds for permanent exclusion for blood donation. The population is 6,374 people once excluding refused donors (4,118 refused individuals are identified)

and our model considers a number of observations equal to 4,039 individuals once removed missing data. We now interpret the results of the estimation of the probit model that includes all variables (Model 2 in Table 8).

Individuals who report being willing to donate their organs have a higher probability (+0.062) of being active donors compared to those who are not willing to do so. Having made a step forward in this direction (such as signing the organ donors' card) increases even more this probability in 0.005, so the total marginal effect on the probability of being active donor for those who say they are willing to donate their organs and that have the organ donor card is 0.067 probability points higher than for the rest of individuals not being willing to donate their organs. Regarding the variable of social capital we find that belonging to an association increases the probability of being an active donor (0.048) compared to those who reported not participating in associations. The more an individual is a risk taker, the higher the probability of being an active donor, with a positive difference of 0.086 probability points with respect to individuals who declare to be more risk averse.

Concerning the socio-economic variables included in the model, the only significant effect was found for the level of education. Being a student but have not yet graduated, compared to those who say they have "no diploma", is also a factor that positively influences the probability of being active donor (+0.132). One could insight that students have a lower opportunity cost to give their blood, compared to other groups, for example, given the easiness for donating blood when the mobile units move into university.

We find no significant effect for health variables, which means that the two groups of donors are equal in terms of perceived health and chronic diseases.

Model 3 shows how, among men (women are excluded for this model), the marginal effects of behavioral variables are stronger compared to the effects found in the estimation of models 1 and 2, where all men and women were included. So when the average effect for the entire population is lesser for some of the variables than the effect found for the population of men only, we can derive that the marginal effects of these variables for the population of women are lower. Two main differences are observed between men and women. The effect of not having yet finished studies disappears when the population of men is analyzed separately. In addition, men aged 50-59 have a higher probability (+0.080) of being active donors compared to younger men aged 18-29.

Table 8. Results for the Standard Probit Model (Marginal Effects)

	Model 1			Model 2			Model 3 (Men only)		
Active Donor = 1	**Marginal Effect**	**S.E**	**P>z**	**Marginal Effect**	**S. E.**	**P>z**	**Marginal Effect**	**S.E**	**P>z**
Behavioural Variables									
Willing to donate organs	0,062***	0,064	0,000	0,062***	0,064	0,000	0,063***	0,087	0,000
Has the organ donor card	0,066***	0,066	0,000	0,067***	0,067	0,000	0,058***	0,103	0,002
Somebody close transfused	0,015	0,069	0,258	0,016	0,070	0,211	0,006	0,101	0,732
Participates in associations	0,049***	0,056	0,000	0,048***	0,056	0,000	0,061***	0,079	0,000
Risk taker	0,083***	0,136	0,001	0,086***	0,138	0,001	0,039	0,177	0,239
Socio-economic variables									
CEP/BEPC/CAP/BEP	0,010	0,122	0,667	0,010	0,123	0,669	0,009	0,160	0,761
Bac	0,001	0,128	0,983	0,006	0,130	0,819	0,006	0,172	0,846
Graduate	0,010	0,145	0,721	0,020	0,147	0,475	0,019	0,203	0,613
Other	-0,013	0,227	0,757	-0,013	0,228	0,759	-0,134	0,432	0,094
Student without diploma	0,123***	0,230	0,005	0,132***	0,241	0,003	0,101	0,447	0,223
Retired	-0,040	0,112	0,059	-0,001	0,178	0,971	-0,013	0,241	0,774
Unemployed	-0,034	0,110	0,102	-0,030	0,112	0,157	-0,051	0,168	0,103
Inactive	-0,036	0,147	0,190	-0,035	0,150	0,209	0,013	0,342	0,842
Artisans	-0,019	0,212	0,628	-0,025	0,213	0,532	-0,038	0,275	0,460
Intelectual profession	0,015	0,178	0,657	0,006	0,180	0,860	-0,008	0,247	0,861
Intermediate Profession	0,026	0,168	0,411	0,020	0,169	0,520	0,016	0,231	0,707
Clerical	0,048	0,168	0,128	0,044	0,170	0,167	0,018	0,258	0,702
Traders	0,000	0,173	0,988	-0,003	0,175	0,935	-0,020	0,322	0,743
Qualified workers	0,047	0,169	0,139	0,040	0,171	0,209	0,031	0,227	0,465
Non-Qualified workers	0,016	0,184	0,637	0,013	0,185	0,713	0,030	0,244	0,511
Income p.u.c (2^{nd} quintile)	0,014	0,098	0,467	0,011	0,099	0,568	0,023	0,145	0,392
Income p.u.c (3rd quintile)	-0,010	0,101	0,609	-0,011	0,102	0,563	-0,014	0,149	0,623
Income p.u.c (4th quintile)	-0,006	0,099	0,750	-0,008	0,100	0,666	0,002	0,146	0,950
Income p.u.c (5th quintile)	0,001	0,102	0,967	-0,003	0,104	0,888	-0,014	0,154	0,616
Health variables									
Poor/ very poor health	-0,101	0,348	0,122	-0,107	0,353	0,106	-0,058	0,387	0,419
Has experienced a chronic illness	0,012	0,074	0,392	0,012	0,075	0,391	-0,015	0,113	0,491
Control Variables									
Female				-0,005	0,061	0,692	NA	-	-
Âge 30-39				-0,011	0,093	0,522	0,018	0,139	0,482
Âge 40-49				0,029	0,091	0,090	0,044	0,136	0,078
Âge 50-59				0,030	0,099	0,108	0,080***	0,142	0,003
Âge 60-70				-0,033	0,184	0,345	0,023	0,250	0,620
Rural area				0,002	0,072	0,895	-0,004	0,102	0,851
Suburban ring				0,000	0,069	0,997	-0,006	0,099	0,728
Multipolarized				0,028	0,115	0,199	0,038	0,158	0,201
N		**4039**			**4039**			**2027**	
Log Likelihood		**-1397,2**			**-1389,7**			**-688,6**	
Pseudo R2		**0,0638**			**0,0689**			**0,071**	
Prob > chi2		**0,000**			**0,000**			**0,000**	

Estimating the Heckman selection model (including the refused donors in the selection equation) gives similar results then those obtained through the standard probit estimation. However, the main difference is that in the Heckman selection model the health variables are not included in the latent equation, but these are the additional variables for the selection equation. The results show that there is a significant difference in terms of perceived health and chronicity between refused and non-refused donors, the later encompassing active and potential donors. The null hypothesis of non-correlation of errors cannot be rejected with a confidence level of 95% ($\rho = 0.032$, λ^{mills}

= 0.01 and the p-value (λ^{mills}) = 0.729). The results found in the standard probit model can therefore be used in this case to give the comparison between the active donors and potential donors, not having a problem of sample selection.

Table 9. Heckman Selection Model Results

Dependent variable of the latent equation: Active Donor =1	Coef.	Std. Err.	z	P>z
Behavioural Variables				
Willing to donate organs	0,056***	0,011	5,000	0,000
Has the organ donor card	0,082***	0,014	5,980	0,000
Somebody close transfused	0,010	0,012	0,810	0,419
Participates in associations	0,049***	0,011	4,550	0,000
Risk taker	0,093***	0,030	3,110	0,002
Socio-economic variables				
CEP/BEPC/CAP/BEP	0,011	0,019	0,610	0,541
Bac	0,003	0,020	0,130	0,900
Graduate	0,022	0,024	0,930	0,350
Other	-0,012	0,037	-0,320	0,751
Student without diploma	0,136***	0,035	3,880	0,000
Retired	-0,012	0,031	-0,380	0,703
Unemployed	-0,018	0,018	-1,000	0,316
Inactive	-0,023	0,024	-0,960	0,335
Artisans	-0,021	0,033	-0,630	0,527
Intelectual profession	0,009	0,029	0,310	0,755
Intermediate Profession	0,028	0,026	1,090	0,277
Clerical	0,049	0,026	1,870	0,062
Traders	0,004	0,026	0,140	0,893
Qualified workers	0,040	0,026	1,570	0,116
Non-Qualified workers	0,015	0,027	0,560	0,572
Income p.u.c (2^{nd} quintile)	0,018	0,018	1,010	0,314
Income p.u.c (3rd quintile)	-0,010	0,018	-0,530	0,593
Income p.u.c (4th quintile)	-0,010	0,018	-0,580	0,564
Income p.u.c (5th quintile)	-0,002	0,019	-0,080	0,933
Control Variables				
Female	-0,007	0,011	-0,610	0,543
Âge 30-39	-0,011	0,016	-0,670	0,504
Âge 40-49	0,028	0,016	1,740	0,082
Âge 50-59	0,029	0,018	1,620	0,105
Âge 60-70	-0,016	0,031	-0,530	0,596
Rural area	0,006	0,013	0,490	0,622
Suburban ring	0,001	0,013	0,080	0,934
Multipolarized	0,032	0,022	1,470	0,140
Dependent variable of Selection Equation: No refused donor=1				
Health variables				
Poor/ very poor health	-0,590***	0,087	-6,790	0,000
Has experienced a chronic illness	-0,438***	0,031	-14,290	0,000
lambda (mills)	0,010	0,029	0,350	0,728
rho	0,032			
sigma	0,319			

Our assumptions concerning individuals' behavior according to altruism, social capital and risk aversion effects on blood donation are confirmed by these models. Concerning socio-economic characteristics, we do not find differences in the economic situation of individuals, which may indicate that economic differences are not an influencing factor for blood donation. Some differences are found for the population of men with respect to the general population. Specifically, men aged 50-59 years have a

younger donate blood actively probability significantly higher than men. Finally, the failure to find differences in perceived health and chronicity between active and potential donors suggests that we have well controlled our population of refused donors, so that the two populations of active and potential donors are comparable with all potential donors having the opportunity to be active donors one day (it is not possible for donors objected, removed from the analysis for this reason).

6. Concluding Remarks

This work was produced using data from the ESPS 2012 questionnaire, which for the first time in 2012 integrates some questions about blood donation among questions on socio-economic and demographic characteristics of the general French population. This is the first time in France that the different blood donor populations, active, potential and refused, are going to be described in terms of a set of variables never analyzed together before in France.

The results show that active donors are generally more altruistic individuals (compared to potential donors), with higher levels of social capital, and more risk-takers. The assumptions higher levels of altruism and social capital for active donors are confirmed for the population analyzed, reinforcing previous literature results. We also found that active donors are more risk takers than potential donors, confirming our hypothesis. Concerning socio-economic characteristics of the blood donor groups, being a student without having yet obtained the diploma, seems to be a characteristic that also increases the probability of being an active donor compared to those who reported not having education.

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4

Encouraging blood donations through advertising campaigns

María Errea

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María Errea

Abstract

This paper explores the impact of new advertising campaigns for blood donation that the blood donors' association of Navarra (ADONA) started implementing in 2010. The aim is to compare these campaigns that ADONA implemented since 2010 with previous ADONA campaigns and other events for encouraging blood donation implemented in the past in the same region. To analyze the impact of pro-donation campaigns we propose three indicators: 1st. the difference in the days between two consecutive donations for each individual, as a measure for variation in the frequency of blood donations when there is a campaign active and where no campaign is active; 2nd. the incremental days between consecutive donations as a measure for variation in regularity on blood donation behavior when there is a campaign active; 3rd. the proportion of new donors with and without campaigns active. Controlling for individuals' characteristics and identifying other events than could be taking place at the same time than the donation campaigns we reduce the estimation bias, and propose a model to better isolate the effect of campaigns. Results show a positive effect of campaigns according to the three measures considered. We conclude that the new campaigns are more effective on the attraction of new donors, and also that there is a learning process of individuals and complementarity/reinforcement effects between campaigns, so that when the campaigns become more frequent, donations become more frequent and also more regular.

Keywords: Blood donation, Policy Evaluation, Panel data

1. Introduction

It is a fact that blood cannot be artificially created, and therefore the only way for obtaining blood is through voluntary donations. The World Health Organization (WHO, 2013) reports that only 1% of the world population donates blood, which is considered the minimum percentage necessary to cover the demand for blood. However, the aging of the population in addition to the lack of new donors to substitute those who retire, increases the risk of the demand for blood not being covered, even at its minimum (Ditto et al, 2003; Greinacher, Fendrich and Hoffman, 2010).

The problem is to find the best mechanism for encouraging blood donations. Donating blood is an altruistic action (Wildman, Hollingsworth, 2009), at least in most countries. While some individuals may be attracted to blood donation by offering a reward (Lacetera, Macis, 2010), we also risk of having deterrent or non-desired effects (Bowles, Polanía, 2012). Related to this argument there is a lot of research done, starting with Titmuss (1972) who specifically analyzed this context and concluded that incentives may undermine intrinsic motivation of blood donors, and even reduce supply of blood. This effect is known as Crowding-Out (Frey, Jegen, 2011). The idea of this theory of crowding-effects is that the introduction of external interventions, such as economic incentives or external rewards, can modify individual's preferences and behavior. A good example for a change in behavior induced by an external intervention is the one explained in Gneezy and Rustichini (2000). In that paper the authors explore the effects of introducing a fine for punishing those parents who collect their children late at school at the end of the day. The result was that those parents who were used to arrive late before the introduction of the fine, arrived even later with the fine, and also when the fine stopped. The authors provide a good illustration about the way external interventions may modify individuals' preferences and obtain undesired results.

In the context of blood donations, the situation can be even more delicate. First, social values, such as altruism, are clearly determining the decision of donating, and therefore introducing incentives may undermine these social values (Bowles, Polanía, 2012). Even if there is a strong interest to see how blood donors would react to incentives, this may be very negative for the activity, changing individuals' perception of the action of donating blood. However, there are other methods to encourage pro-social activities. This paper analyzes the effect of non-economic incentives, specifically,

of a set of blood donations campaigns and events that have been implemented in the last years with the objective of encouraging blood donations.

Although there is a highly developed literature to estimate the cause of campaigns or promotion events, there is little consensus on the best way to study the consequences of such promotion events (Allison, 1994). In the context of blood donations, few data have been published on the evaluation of blood donation campaigns (Wakefield, Loken and Hornik, 2010), joining the effort of blood donors associations and mass media campaigns. One is a study of a campaign implemented to promote blood donation in China, which used celebrities and patriotic messages to increase the number of voluntary blood donors. Another study in Ghana, a low-cost radio campaign, showed an increase in the number of young male donors, who suddenly changed their donation behavior and started attending to repeated blood donation as a consequence of the campaign (Allain et al., 2008).

In general, for campaigns which target is to promote healthy habits, results show success in the short-term, but difficulties to hold on these effects to longer-terms. Many studies conclude that sustained effects of campaigns for healthy habits are difficult to maintain once the campaign has ended (Pomerleau et al, 2005; Sanigorski et al, 2008; Cavill, Bauman, 2004; Marcus et al, 2006; Finlay, Faulkner, 2005; Norman et al, 2007). Therefore, the topic of sufficient exposure of the population to campaign messages is a concern (Emery *et al*, 2007). Isolating the effects of campaigns, and especially when multiple campaigns are being implemented in short time periods to the same population is, however, a difficult task (Rocella, 2002; Cavill, Bauman, 2004; Kahn, Ramsey, Brownson, 2002).

The purpose of this paper is to explore both existing gaps according the literature. On the one hand, to explore and try to isolate as much as possible the impact of blood donation campaigns that a Blood Donors Association implemented in a given population. On the other hand, we explore the impact of campaigns when considering different lifetimes of campaigns, and also we will show that there is a complementarity effect between campaigns.

In particular, we explore the impact of campaigns through the measure of the following outcomes: the "individuals number of days since last donation" (as a measure of individuals' frequency of donation when campaigns are active), the "mean change in the days since last donations" for individuals (as a measure for regularity), and the proportion of new donors. Comparing each of these measures in the periods when a

campaign is active with respect when no campaign is active we give an estimation of the impact of the campaigns. Given that there is a period of three months minimum between two donations for any individual, a sensitivity analysis is made, considering different life-times for the campaigns. First, we will consider that campaigns are active during fifteen days and estimate the mean days between donations, the incremental mean days between donations, and the proportion of new donors at the periods where a campaign is active. Then, we increase the life-time of the campaigns to one and three months. We hypothesize that the effect of the campaigns may be stronger the first days but continue having an impact after some time, some individuals having probably donated just a few days before the starting date of the campaign.

We consider that the mere provision of extra information through blood donations' campaigns could be effective on increasing blood donations by increasing the blood donors' frequency or regularity of donations, and attracting new donors.

The paper is organized as follows. In the next section we present the data and the regression methods for analysis. Section 3 presents descriptive and regression results. We show that there is a positive impact of campaigns, and that this impact is stronger in the first days of life of a campaign, but the effect is maintained when we increase its life-time. We also show that there is a dominant effect for the first and the last campaign, among all the campaigns analyzed in the time horizon considered. The study limitations and further research are discussed in section 4. Finally, section 5 concludes.

2. Methods

2.1 Population and Data description

Navarra is the first Spanish region in the ranking of donations, having the highest proportion of donors per thousand inhabitants, around 50 in the last years, a number which is very far from the Spanish mean, 38 blood donors per thousand inhabitants (FIODS, 2013). However, the need for blood in Navarra is higher than in other regions, in order to cover the needs for the hospital to carry on all the transfusions made for multiple surgery and other treatments.

Data for this study has been provided by the Blood Donors Association in Navarra (ADONA). According to these data, there are about 55,000 registered donors in the region of Navarra. This is near the 10% of the total population of this Spanish region.

Among them, about 27,000 individuals donate each year (5% of the population), and 19,000 of them are active donors (ADONA considers active donors to individuals who have donated at least once in the last three years).

We have daily registers from 25,188 blood donors since 2008 and a total of 159,318 registered donations between January 2008 and April 2013. For each day we have information about who donated and also some individual characteristics such as gender, age, blood type, the date of first and last donation, the type of donation made (blood donation, aphaeresis, and auto-transfusion). The total number of donations for each individual is not given but it can be calculated as we have the number of donations for each individual before 2008 (our starting year recording donations) and each time an individual donates after 2008 is also recorded. Individuals are identified by an ID number generated to preserve their anonymity.

An increasing effort of ADONA on advertising has been observed since January 2010. Much more campaigns have been implemented in the last two years (2010-2013) than in the previous period (2008-2010). This paper focuses on estimating the impact of these new pro-donation campaigns, and comparing them with the previous years, where campaigns or pro-donation events were scarce. We consider blood donation campaigns but also other donation campaigns that the same Blood Donors Association implemented (i.e campaigns for encouraging bone marrow donations) under the hypothesis that any campaign that is launched by the Blood Donors' Association may have an impact on blood donation.

The following table shows a list, in chronological order, of the pro-donation campaigns or other events, that have took place during the last five years.

We distinguish between pro-donation campaigns, pro-donation events, and permanent changes. The main difference between the first two is that a campaign is a call for donation, while events are organized in recognition to the population of blood donors. In addition, we assume that the minimum life-time for a campaign, that is the time that a campaign should be considered being active, is 15 days, while we consider events as shocks which have a duration of one day (for example, the World blood donors' day, celebrated every year the 14th of June). A permanent change is an event that occurred during the time we are analyzing that has not ended and that could be affecting the outcome of interest. We include one unique permanent change, which is the extension of the extraction and donor care times the 13th of December 2010.

The following table shows the different campaigns, events and permanent changes that can be localized in the time we are analyzing. We separate the table in two periods: January 2008-December 2009 and January 2010- April 2013. The number of campaigns implemented in the period 2008-2010 was smaller in than the number of campaigns after January 2010. Before 2010 the only campaign implemented was for encouraging bone marrow donation.

Table 1. History of pro-donation campaigns since 2010

Date of start	Campaign Description
January 2008-End December 2009	
14-06-2008	**Event #1:** The world blood donors' day 2008
04-04-2009	**Campaign #0:** Bone Marrow donation campaign
01-06-2009	**Event #2:** Recognition to donors having achieved 50, 100 and 150 donations in 2008)
14-06-2009	**Event #3:** World Blood Donors' day 2009
24-06-2009	**Event #4:** Tribute to blood donors in Navarra
11-09-2009	**Event #5:** ADONA published a study in the local press about the necessity of generational change
January 2010- End April 2013	
18/01/2010	**Campaign #1**: 1st phase of the blood donation campaign "¿Y tú, qué eres?"
01/02/2010	**Campaign #2**: 2nd phase of the blood donation campaign "Y tú, qué eres?"
14/06/2010	**Event #1**: World Blood Donors' day 2010
13/12/2010	**Permanent Change**: The extraction and donor care times are extended
11/06/2011	**Campaign #3**: One day campaign: ADONA in the streets of Pamplona
14/06/2011	**Event #2**: World Blood Donors' day 2011
23/08/2011	**Campaign #4:** Summer campaign of the National Red Cross and ADONA
23/09/2011	**Campaign #5:** Campaign for blood donations: "Yo doy la cara, ¿y tú?"
01/06/2012	**Campaign #6:** The regional soccer team dedicates the month to blood donors
14/06/2012	**Event #3:** World Blood Donors' day 2012
21/09/2012	**Campaign #7:** The extraction mobile unit for blood donation went to the University of Navarra
05/11/2012	**Event #4:** A tribute to senior donors (50, 100, and 150 donations made)

Undeniable is that the Blood Donors Association in Navarra has invested a strong effort and economic resources for these advertising campaigns in the last two years, using visual advertising campaigns, shocking messages and posters in the bus stops and in the street walls. However, nobody has made yet the effort of evaluating the impact of these campaigns. We start by briefly describe each of the campaigns and other pro-donation events. To better understanding of the objectives of each of the pro-donation campaigns and events, a brief description of the campaigns is provided in the table below (see the annex at the end of this paper for a more detailed description of each of the campaigns and events).

Table 2. Description, slogan and target of ADONA pro-donation campaigns and events in the period 2008-2013

Campaign	Description	Date start	Message/Slogan	Target of campaign
Campaign #0	Bone Marrow Donation campaign	04/04/2009	Your other half is there	To encourage individuals to donate bone marrow
Campaign #1	*Y tú, ¿qué eres? (1st phase)*	18/01/2010	*Y tú, ¿qué eres?*	To approach the concept of blood donation to the young population
Campaign #2	*Y tú, ¿qué eres? (2nd phase)*	01/02/2010	Positive or negative. We want you as you are	To show the importance of having blood donors of all types
Campaign #3	ADONA in the streets of Pamplona	11/06/2011	Give your face for blood donation	To inform to all the population about blood donation and how to become a donor
Campaign #4	Summer Campaign (ADONA + Red Cross)	23/08/2011	This summer love yourself and think of others	To prevent the scarcity of blood donations usually observe during the summer
Campaign #5	*Da la cara*	23/09/2011	*Yo doy la cara, ¿y tú?*	To create identity of being a blood donor and increase blood donations
Campaign #6	OSASUNA dedicates the month to blood donors	01/06/2011	We are 12 with you	To show the importance of blood donation and publicly recognize this action
Campaign #7	The Mobile Unit is installed at university	21/09/2012	Be passionate for the red	To promote blood donation among the University population
Event	**Description**	**Date**	**Message/Slogan**	**Target of campaign**
The World Blood Donors' Day	Event to celebrate the date of birth of Dr. Karl Landsteiner, the discoverer of blood groups	Every 14th of June	Paint the world in red (year 2011)	To recognize the figure of the blood donor voluntary and altruistic all around the world
Tribute to senior blood donors	Golden bandages are distributed to blood donors having reached 50, 100 and 150 donations	01/06/2009 24/06/2009 05/11/2012	No slogan	To socially and officially thank and recognize the action of blood donors
The times for extraction of blood and donor care are extended	The time for blood donation and donor care is extended to Friday Mornings, and Monday to Thursday there are no interruptions between 8am and 8pm	13/12/2010	No slogan	To facilitate blood donation for individuals who have more incompatibilities with daily schedule

2.3 Regression Methods. Panel Data

We want to estimate the impact of each of the campaigns implemented by the Blood Donors' Association of Navarra, on the frequency and regularity of blood donations, as well as on the capability of attraction of new blood donors.

Consider a linear panel-data model (Wooldridge, 2010) on the form:

$$y_{i,t} = \alpha_t + c_{i,t} \cdot \beta_k + x_{i,t} \cdot \gamma_j + z_i \cdot \delta_p + \mu_i + \varepsilon_{i,t}$$

$$\forall t = \{1, 0\}, k = \{1,..., K\}, p = \{1,..., P\} \qquad (1)$$

Where $y_{i,t}$ is the vector of outcomes of interest. As we are going to estimate three different outcomes $y_{i,t} = (y_{i,t}^{(1)}, y_{i,t}^{(2)}, y_{i,t}^{(3)})$. A separate model is estimated for each of the outcomes. $c_{i,t}$ is a vector of the K campaigns, a binary variable for each campaign/event, with value 1 when the campaign is active and value 0 for the periods without campaign; $x_{i,t}$ is a vector of individuals' characteristics which vary across individuals and across time (such as age or the number of total donations); z_i is a vector of p individual time invariant characteristics (gender and blood type). The constant term (α_t) represents the mean of the outcome of interest at *t=0*, that is similar to the mean outcome when no campaign is active, and $\alpha, \beta_k, \gamma_p, \delta_p$ are the parameters to be estimated. This model assumes there is an error in the estimation due to individual characteristics which are time invariant (μ_i) or time variant ($\varepsilon_{i,t}$) that we are omitting in the model and could be relevant for the estimation.

In our case we analyze the impact of campaigns over three outcomes of interest: 1. The difference in the mean of the days since last donation for each individual in *t=1* and *t=0*; and 2. The mean variation in the days since last donation in *t=1* and *t=0*. 3. The difference in the proportion of new donors in both periods.

For *k=1* and *t={0, 1}*, that is if there is only one campaign and two periods, the estimated effect of a campaign would be, for each of the measures, the difference in the outcomes in the two periods, *t=1* and *t=0*, conditioned to the individuals time variant and time invariant characteristics observed in the population. That is:

$$E(y_{i,t}) = E(y_{i,t=1} \mid X, Z) - E(y_{i,t=0} \mid X, Z) \qquad (2)$$

Given the lack of similar previous studies analyzing the impact of blood donation campaigns, there is no agreement on the life-time that should be considered for a campaign. Thus, we will consider three different campaign life-times: 15 days, one month and three months.

The problem of this simple model is that we are omitting variables in the model, other than pro-donation campaigns or events, which could affect to the outcome of interest. For example, it is known that an individual who is near (under) 50, 100 and 150 donations receives a medal when arriving to that number of donations, as a

compensation for his contribution. Therefore, identifying this individuals and their weight over the whole sample, may be important. If there is an effect of these medals, the behavior of these individuals should be an increase in regularity until they arrive to 50, 100 or 150, and then decrease their regularity. With a simple test based on following individuals along the time we can identify if the omission of this variable would be introducing (or not) a bias in our estimation.

We need to estimate a model of differences such that we explain as much as possible what is in the error term of the previous model (equation 1). The estimator should be the difference between the outcome variable in different time periods, but now we consider daily data, and control for those events that we hypothesize that omitting them would lead into a bias of our estimation of the effect of the campaigns. The model we estimate includes dummy variables that take value 1 if a campaign ($c_{i,t}$), event ($e_{i,t}$), or permanent change ($pc_{i,t}$) was occurring at the moment of donation $t \in T$. This model is written as follows:

$$y_{i,t} = \alpha + c_{i,t} \cdot \beta_k + x_{i,t} \cdot \gamma_j + z_i \cdot \delta_p + e_{i,t} \cdot \phi_l + pc_{i,t} \cdot \varphi_m + (x_{i,t} D) \cdot \omega_q + (z_i\ D) \cdot \vartheta_r + \mu_i + \varepsilon_{i,t}$$

$$\forall t = \{1,...,T\}, k = \{1,...,K\}, l = \{1,...,L\}, m = \{1,...,m\},\ j = \{1,...J\}, p = \{1,...,P\}, q = \{1,...,Q\}, r = \{1,...,R\} \quad (3)$$

Where $i=\{1,\ldots,n\}$ represent the individuals and t represent the time measure (daily data), $k=\{1,\ldots K)$ represent the K campaigns, $l=\{1,\ldots,L\}$ represent the L additional pro-donation events, $m=\{1,\ldots M\}$ represent M permanent changes that occur at any $t \in T$. The individual-level effect is represented by μ_i, and $u_{i,t}$ is the idiosyncratic error (error of the estimation due to the omission of variables that either change for individuals or with time, that would be relevant for explaining the outcome of interest). $c_{i,t}$ and $e_{i,t}$ are vectors of dummy variables, where each variable equals 1 if a campaign or pro-donation event was active when the individual i went to make a donation at time $t \in T$, and 0 otherwise; $pc_{i,t}$ is a vector of the permanent changes that could affect our outcome measure, each of these permanent changes being a dummy variable that takes value 1 since the change is implemented and 0 before the change is implemented. In our case there is only one permanent change during the time period we are analyzing. Therefore it $pc_{i,t}$ is a vector of one unique variable ($m=1$ in the model). To better estimate the impact of the campaigns, pro-donation events, and permanent changes on the outcome of interest, we introduce some control variables that are variant with time ($x_{j,t}$, j

representing characteristics, such as the age or the total number of donations when they approach to the thresholds of 50, 100 and 150, as an indicator of individuals being close to receiving the gold bandages), as well as individual characteristics that are time invariant (z_i), such as gender or the blood type, and interaction effects between some of the control variables and individual characteristics with a dummy variable *D* that takes value 1 if the donation time is any date after the date of start of the new pro-donation campaigns (January 18th 2010) and value 0 otherwise. Interactions (time variant, $X_{j,t}$ *D*, and time invariant, Z_i *D*) are included to evaluate the behavioral changes among individuals of different age groups, gender, being close to a medal in the moment of donation, and having received a medal before and after the date of the start of the new campaigns. Again ε_i is the error term at the individual-level and $u_{i,t}$ is the idiosyncratic error (error at the individual and time levels).

We estimate this model using Generalized Least Square estimation, that means that we assume that the correlation between $u_{i,t}$ and the independent variables that vary with the time is zero (the random effects model).

In the first estimation the dependent model of is the days between consecutive donations for each individual who went donating at time *t*.

We create this variable as follows:

First, we calculate the distance between two donations, in days, for each individual. That is our first outcome of interest ($y_{i,t}^{(1)}$):

$$y_{i,t}^{(1)} = \left[date\ donation_i\right]_t - \left[date\ donation_i\right]_{t-1}$$

For an individual who donates blood at times *t* and *t-1*, $y_{i,t}^{1}$ is the distance in days between these two dates of donation.

Once we have done so for all the individuals in the data set, we can compute the mean of $y_{i,t}$, that is to say, at each time period we compute the sum of the days since last donation for all the *n* individuals donating at time *t*, and divide this sum by the total number of donations registered that day, which is equal to divide by the number of donors registered that day (n_t):

$$\frac{\sum_{i=1}^{n} y_{i,t}^{(1)}}{n_t} = \frac{\sum_{i=1}^{n} \left(date\ donation_i\right)_t - \left(date\ donation_i\right)_{t-1}}{n_t}$$

In the second model the dependent variable is the individuals' incremental days between donations at time *t*. That is, following individuals along the time, each time an individual makes a donation, we do the difference between the days since last donation at that time and the days between donations at *t-1*.

$$y_{i,t}^{(2)} = \Delta y_{i,t}^{(1)} = y_{i,t}^{(1)} - y_{i,t-1}^{(1)}$$

$$y_{i,t}^{(2)} = \left[\left(date\ donation_i\right)_t - \left(date\ donation_i\right)_{t-1}\right] - \left[\left(date\ donation_i\right)_{t-1} - \left(date\ donation_i\right)_{t-2}\right]$$

Then, we can compute, for each day in the data set, what is the daily mean of the incremental days since last donation as the sum of all the individual variations divided by the total number of donors at that time *t* ($\bar{y}_t$):

$$\bar{y}_t^{(2)} = \frac{\sum_{i=1}^{n}\left(y_{i,t}^{(1)} - y_{i,t-1}^{(1)}\right)}{n_t} \quad \forall t = \{1,...,T\}$$

Finally the dependent variable of the third model is the proportion of new donors at time *t*. This proportion of new donors is calculated as the ratio between the number of new donors at time *t* and the total number of donations at that time *t*.

$$y_{i,t}^{(3)} = \frac{\sum newdonor}{n_t} \quad t = \{1,...,T\}$$

$$y_{i,t}^{(3)} = \lambda_t \quad \forall \lambda \in (0,1)\,,\, t = \{1,...,T\}$$

So, a value of λ =1 would mean that from the total of individuals donating at time t, the 100% are new donors. Any value in the (0, 1) for λ represents the proportion of new donors at time *t*.

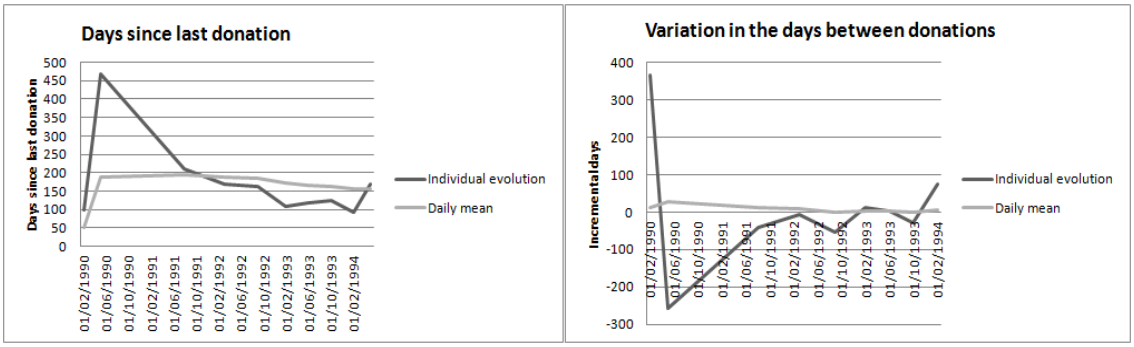
To better understand the two first measures we show and example with one individual in the data set. We follow an individual (identified with an ID number in the data set) along time and compare him/her with the population average for each of the dates this individual made a donation.

We observe how this individual behaves along time, that is, the distance between each pair of donations and the variations in the frequency of donation for this individual. We also compute the daily mean for each of the measures in order to see the evolution of the individual and how the individual behaves with respect to the average of the population.

We observe that for our individual, between the first and the second donation there is a distance of a hundred days, and 450 days between the second and the third

donation. After the third donation, and for the next donations in time, this distance between donations decreases for this individual. So, this individual has strong fluctuations in donation behavior the first periods, and then this fluctuations decrease as the distance between donations decrease and donations became more regular too. The figures also show the daily mean, which is, for each day, the sum of $y_{i,t}$ or $\Delta y_{i,t}$ divided but the total number of donors at that day.

Figure 1. Example of the days between donations and its fluctuations along time for an individual



For the first outcome measure, the days since the last donation for each individual at each donations moment, we fixed a minimum value of 90 days for men and 120 for women for a standard blood donation according to the regional blood bank criteria. This means that if we have a woman for whom the days since the last donation are less than 120 days this observation is removed for the analysis. We also removed observations for those whose days between donations are higher than 1553 days (1945 is the total number of days in the period of analysis 1st of January 2008 and 30th of April 2013). We have to suppress the days where donation was not possible (240 in total in the time analyzed, coming from 48 weekends per year plus Fridays, that is 96 days per year between 2008 and 2010 plus 48 Fridays, and 96 days per year after the extraction time was extended to Fridays). Individuals whose days between donations exceed 1705 days are excluded from the analysis. In fact, the proportion of individuals reporting a distance between donations higher than 1000 days is really small; the maximum distance observed is 8125 days, so that including these individuals would lead into a strong bias in our estimations.

In all the three models the independent variables represent the dates where donation was registered, either at the moment where a campaign was active ($C_{i,t}=1$) or an event

was taking place ($E_{i,t}=1$) or after the permanent change was implemented ($PC_{i,t}=1$). We also include the following control variables: are the age of the individual at each donation time (age categories are included instead of the continuous variable, in order to compare between individuals of different age classes), the gender, blood type O^- (the reference group being AB), the fact of being close to receiving a medal (that is being in the following intervals of number of total donations: [47, 50) , [97, 100) and [147, 150)) or having just received a medal (in that case being in the following intervals of total number of donations: [50, 53], [100, 103] and [150, 153]). This variable allows to see if the individuals' behavior towards donation changes during the year previous receiving the medal and after having being rewarded.

3. Results

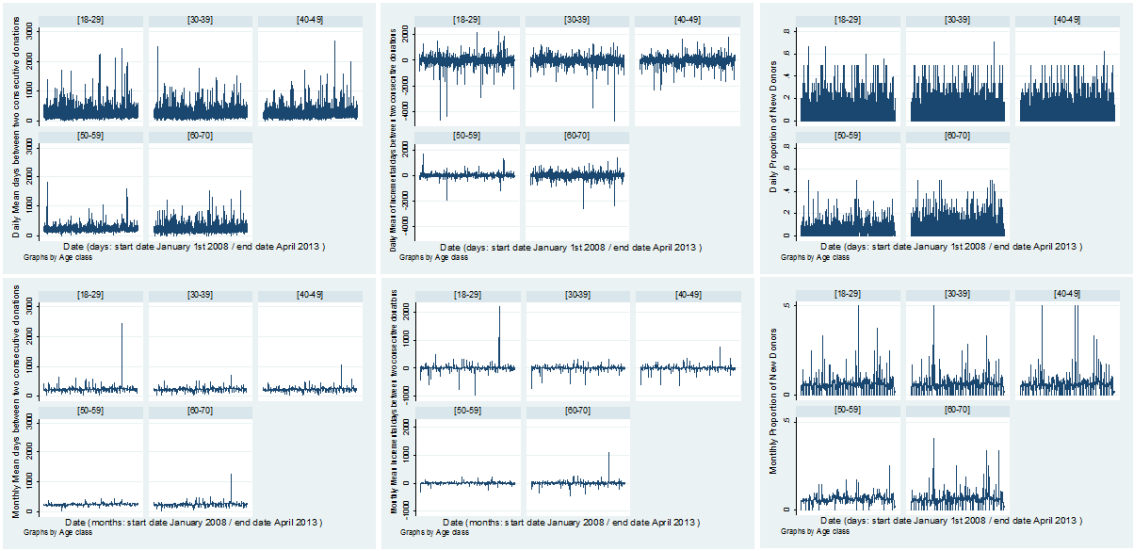
3.1 Descriptive Results

We have an unbalanced panel data set, with a total of 25188 different donors registered since January 2008, and 159318 donations registered until end of April 2013.

Among blood donors, the 29.26% of the donations are made by women and 70.74% by men. The most frequent blood groups are the O (50.83%) and A (41.91%). The other groups are less frequents (AB and B with 2.23% and 4.97% respectively). Almost all donations, the 97.26%, are normal donations, with a small percentage of auto-transfusions (2.37%) and negligible for Aferesis (0.36%). We first show descriptive results of the three outcomes of interest evaluated in this paper as measures for the impact of pro-donation campaigns.

The figure below shows the evolution along time, by age class, of these three measures. We also represent a third measure, which is the proportion of new donors. For these three outcomes, we represent daily and monthly evolution. The graphs show the daily (up) and monthly (down) evolution of the three measures considered. It is observed that the mean days between donations (left graphs) decreases with age. Individuals aged 50 to 59 let, on average, pass less days (in mean) since last donation than the youngest individuals, those aged 18-29, whose the mean days between two consecutive donations is in mean close to a hundred days.

Figure 2. Daily and Monthly evolution, by age class, for the Mean days between donations (left), Incremental mean days between donations (middle) and proportion of new donors (right).



3.2 Regression Results

The following tables show the results of the estimation of the impact of pro-donation campaigns on the three outcomes of interest: the days between consecutive donations (Table 3), the incremental days between consecutive donations (Table 4), and the proportion of new donors (Table 5). We estimate both models considering three different life-times for the campaigns: 15 days, one month, and three months.

The intercept of the models measures the mean days between consecutive donations during the periods where there was no campaign active ($C_k=0$). The coefficients for each of the campaigns measure the variation (positive or negative) in the mean days between consecutive donations for the different life-times considered (15 days, one month and three months), with respect to the periods without campaigns. We observe that results are very similar independently of the life-times considered, either for the coefficients for the campaigns or for the control variables. Therefore, below we interpret results for the case where campaigns have a life-time of 15 days. The mean days since last donation for individuals is about 295,457 days during the periods when no campaign or event is implemented (248.715 if we include control variables, individual-level effects and interaction terms). During the days that the first campaign was being implemented (C0) the mean days since last donation were 5.483 days more than when no campaign was implemented. The first campaign in which a positive and significant effect (reduction in the mean days since last donation) is observed is the Campaign #1.

During the days this campaign was active the mean outcome decreased in 8.743 days (14.281 when we include the control and interaction variables). We observe that between C1 and C6 no significant effects are found. We have to wait until the last campaign, C7, to observe a reduction in the days since last donation of 14.042 days with respect to when no campaign was implemented. We do not find significant effects for the additional pro-donation events (the world blood donors' days and tribute to blood donors). The extension of the extraction and donor care times are not significant, and therefore we cannot reject the hypothesis of null impact of this change over the outcome of interest. However, we do for control variables included. There is a significant difference between men and women, women having in mean 108.276 days more between donations than men, and individuals of the universal blood type O- in mean donate more regularly (with 6.904 days of difference with respect to individuals of group A). Being close to receiving a medal also makes individual donate, in mean, 17.9 days before than those individual who are not close to receiving such a recognition. However, once individuals have received that medal, they continue donating less regularly. Therefore, the medal is a significant factor influencing the regularity of donors. Concerning the interaction variables we see that both, men and women are donating less frequently in the last two years (after 2010) with respect to their donation behavior between 2008 and 2010. Men donate 9.3 days later in mean, and women 18.47 days later. The difference is, however, not statistically significant between both sexes. The younger individuals donate also less frequently after 2010 than before, 12.938 days later after 2010, while those aged 40 to 50 years donate more frequently, 7.802 days before with respect to the period 2008-2010. Finally, those individuals who donate and are close to receiving the medal after 2010 donate less frequently than those individuals being close to receiving the medal in the period 2008-2010. Therefore, having show that the effect of the medal is positive increasing frequency of donations, we can say that its effect is lower in the last years, when more campaigns are being implemented. For the three campaign life-times we obtain similar results in terms of significance of the variables. However, it can be seen that the coefficients for the campaigns are higher for the first life-time of 15 days, meaning that the first days of a campaign being active are those in which the impact of that campaign is stronger. The fact that increasing the life-time the coefficient is still negative and significant suggests that the campaign continues having a positive impact even after three months.

Table 3. Results from GLS estimation (random effects assumed)

Impact of campaigns on the days between two consecutive donations

Days between donations	**Campaign life = 15 days**		**Campaign life = 30 days**		**Campaign life = 90 days**	
Variable	**Model 1.1**	**Model 1.2**	**Model 1.3**	**Model 1.4**	**Model 1.5**	**Model 1.6**
intercept	295.457***	248.715***	295.634***	248.674***	295.125***	248.471***
C0	5.483	12.828**	-0.167	7.192	-2.988	4.065*
C1	-8.743**	-14.281***				
C12			-2.249	-9.212***	-0.804	-10.021***
C2	11.769**	7.061				
C3	3.169	-0.930	-0.002	-4.452	2.842	-1.339
C4	2.320	-2.086	2.839	-1.600		
C45					4.770***	-0.101
C5	1.442	-2.836	-2.030	-6.752*		
C6	1.335	-2.482	1.089	-3.164	4.024*	-1.023
C7	-9.997**	-14.042***	-8.960***	-13.253***	-4.276**	-9.176***
Event		-3.854		-3.304		-3.796
Permanent change		-0.965		-1.133		-2.997*
Female		108.276***		108.263***		108.291***
Group O-		-6.904**		-6.916**		-6.941**
Number of donations close to Medal		-17.922***		-17.905***		-17.820***
Has received a medal and done máximum 3 donations more		-14.050***		-14.075***		-14.007***
Female*After2010		18.470***		19.262***		21.556***
Male*After2010		9.300***		10.091***		12.381***
age18-30*After2010		12.938***		12.929***		12.928***
age30-40*After2010		3.179		3.147		3.153
age40-50*After2010		-7.802***		-7.866***		-7.819***
age50-60*After2010		-4.751		-4.795		-4.653
age60-70*After2010		(omitted)		(omitted)		(omitted)
groupO*After2010		-2.190		-2.190		-2,171
medal*After2010		11.022*		10.974*		11,100*
aftermedal*After2010		9.830		9.930		9,819
$\sigma_{\mu\, i}$	210.634	199.968	210.551	200.013	209.986	199.905
$\sigma_{\varepsilon i,t}$	147.483	147.289	147.485	147.287	147.467	147.275
Fraction of variance due to μ_i	0.671	0.648	0.671	0.648	0.669	0.648
Number of observations (donations)	124734	124734	124734	124734	124734	124734
Groups (individuals)	21967	21967	21967	21967	21967	21967
R2 (overall)	0.0001	0.061	0.0001	0.0611	0.000	0.0609

Results of the second model (outcome measure is the incremental days between donations at time *t*) show that the incremental days between donations is, in mean, 48.087 days lower when no campaign or event is active and no permanent change has occurred (the coefficient for the intercept) than when a campaign, event or permanent change occurs. For some of the campaigns there is also a positive effect (a negative coefficient meaning a reduction in the incremental days between donations) over the outcome. These two results confirm the hypothesis that campaigns may have a positive effect reducing the fluctuation on donors' frequency of donation, but the effect of campaigns may be observed later in time, and not necessarily during the campaigns' life. Concerning the control variables we observe that women have less fluctuation in

their donation behavior. They donate less frequent than men but they have more stable behavior, especially after 2010.

Table 4. Results from GLS estimation (random effects assumed)

The impact of campaigns on the incremental days between two consecutive donations

Incremental Days between donations	**Campaign life = 15 days**		**Campaign life = 30 days**		**Campaign life = 90 days**	
Variable	**Model 2.1**	**Model 2.2**	**Model 2.3**	**Model 2.4**	**Model 2.5**	**Model 2.6**
intercept	-49.837***	-48.087***	-49.679***	-48.116***	-51.875***	-48.421***
C0	6.087	24.953*	-6.647	12.205	-11.378**	5.036
C1						
C12			-18.473***	-23.324***	-10.374**	-20.886***
C2	-0.168	-2.503				
C3	-6.681	-24.377**	-5.735	-23.298***	-0.058	-14.411***
C4	0.972	-15.273	2.096	-13.734*		
C45					9.975***	-5.560
C5	-9.575	-25.598**	0.739	-15.117*		
C6	-1.352	-17.520**	-1.408	-18.346**	12.797***	-4.733
C7	10.580	-5.585	8.600	-7.919	26.926***	9.429*
Event		15.241		14.604		7.933
Permanent change		13.460***		12.849***		8.419**
Female		-49.579***		-49.605***		-49.564**
Group O-		-10.569		-10.578		-10.625
Number of donations close to Medal		19.452*		19.440*		19.506*
Has received a medal and done máximum 3 donations more		25.525**		25.464**		25.539**
Female*After2010		44.367***		45.733***		49.156***
Male*After2010		23.402***		24.771***		28.164***
age18-30*After2010		-4.662		-4.574		-4.000
age30-40*After2010		-0.609		-0.565		0.022
age40-50*After2010		-3.694		-3.698		-3.217
age50-60*After2010		-8.235		-8.403		-8.103
age60-70*After2010		(omitted)		(omitted)		(omitted)
groupO*After2010		-4.369		-4.342		-4.265
medal*After2010		-22.668*		-22.761*		-23.139*
aftermedal*After2010		-23.616		-23.534		-23.894
$\sigma_{\mu\, i}$	464.931	456.592	464.745	456.474	462.674	456.739
$\sigma_{\varepsilon i,t}$	339.713	338.994	339.705	338.982	339.558	338.964
Fraction of variance due to μ_i	0.651	0.644	0.651	0.644	0.649	0.644
Number of observations (donations)	118884	118884	118884	118884	118884	118884
Groups (individuals)	20403	20403	20403	20403	20403	20403
R2 (overall)	0.000	0.0003	0.000	0.0003	0.000	0.0003

The last measure is the proportion of new donors. Regression results from GLS estimation show that the new campaigns are more effective than the reference campaign C0. In fact, during the period the reference campaign was active, the proportion of new donors decreased (-0.011). At the time the new campaigns were active (C1 to C7), the proportion of new donors in general increased with respect to the periods where no campaign was active. We only observe that during campaign #5 there is a decrease in the proportion of new donors. The results are similar for the three different campaign life-times of 15 days, one month and three months. Concerning the control variables and

interaction terms, we observe that the extension of the time for blood extraction and donor care has also a significant influence on increasing the proportion of new donors (+0.001). The proportion of men and women who donate for the first time after 2010 has also increased, slightly more for women (+0.006) than for men (+0.005).

Table 5. Results from GLS estimation (random effects assumed)

The impact of campaigns on the Daily proportion of New donors

	Campaign life 15 days		**Campaign life 30 days**		**Campaign life 90 days**	
Proportion of New Donors	**Model 3.1**	**Model 3.2**	**Model 3.3**	**Model 3.4**	**Model 3.5**	**Model 3.6**
intercept	0.059***	0.055***	0.058***	0.055***	0.059***	0.055***
C0	-0.011***	-0.007***	-0.009***	-0.006***	-0.007***	-0.003***
C1	0.004***	0.003**				
C12			0.013***	0.012***	0.009***	0.010***
C2	0.020***	0.019***				
C3	0.011***	0.008***	0.002*	-0.001	0.003***	-0.001
C4	0.009***	0.006***	0.008***	0.005***		
C45					0.001***	-0.003***
C5	-0.001	-0.004***	0.013***	0.011***		
C6	0.002**	-0.001	0.002**	-0.001	0.005***	-0.000
C7	0.024***	0.021***	0.017***	0.014***	-0.001	-0.006***
Event		-0.002		0.000		0.001
Permanent change		0.001***		0.002***		0.006***
Female		-0.000		-0.000		-0.000
Group O-		-0.000		-0.000		-0.000
Female*After2010		0.006***		0.005***		0.004***
Male*After2010		0.005***		0.004***		0.002***
age18-30*After2010		0.001		0.001		0.001
age30-40*After2010		0.000		0.000		0.000
age40-50*After2010		-0.000		-0.000		-0.000
age50-60*After2010		-0.001		-0.001		-0.001
age60-70*After2010		(omitted)		(omitted)		(omitted)
groupO*After2010		0.000		0.000		0.000
$\sigma_{\mu\, i}$	0.003	0.0028	0.003	0.0028	0.003	0.003
$\sigma_{\varepsilon i,t}$	0.045	0.0457	0.045	0.045	0.045	0.045
Fraction of variance due to μ_i	0.004	0.0039	0.004	0.0039	0.005	0.004
Number of observations (donations)	124734	124734	124734	124734	124734	124734
Groups (individuals)	21967	21967	21967	21967	21967	21967
R2 (overall)	0.0053	0.0101	0.0064	0.01	0.004	0.0087

4. Discussion

In this paper we considered a period of five years for analysis (2008-2013), but the time period could be extended as information about blood donations is available from 1990. However, between 1990 and 2010 the number of pro-donation campaigns has been very scarce. It is in fact after 2010 that the Blood Donors Association starts to actively implement blood donation and related campaigns. For this reason, we have restricted the time period for analysis to the last five years, having two time periods of similar size and therefore comparable, and being sure that the first half of the period analyzed we have complete information to localize all the campaigns that ADONA implemented. Comparing the periods 1990-2010 with 2010-2013 is therefore unfeasible by now, we have not been able to locate all the possible events and pro-donation events that occurred since 1990. As we cannot say that no campaign was implemented between 1990 and 2008, we cannot consider this period in our analysis. Therefore, we decided to cut the period for analysis at 2008, as by now we have been able to locate all the events and campaigns that took place between 2008 and 2013, but not before 2008.

Concerning the other events that could have an impact over the outcomes of interest analyzed, we have considered the events such as the World Blood Donors' Day (which is celebrated every year the 14th of June), the tributes to senior blood donors (organized every year but without a fixed date to reward with a golden bandage to individuals who have reached a total number of 50, 100 and 150 blood donations), and the changes in the blood donation system, such as the extension of the extraction and donor care times. However, one could think about other events that could have an impact on blood donors' behavior, such as world catastrophes in which a world call for blood donation is made by other organizations such as the Red Cross or similar. However, this study had the purpose of evaluating the impact of ADONA pro-donation campaigns on blood donors' behavior in the population of Navarra, and therefore we will assume for this paper that campaigns of other organizations have no impact over blood donations in our population. Further research will therefore focus on identifying every event, campaign or changes in the blood donation system, reducing the probability of having omitted variables that would be relevant for the analysis.

Another topic for research could be doing cost-effectiveness of the campaigns. However, we do not have accurate information about the costs of campaigns, and that is

the reason why this paper focuses only on effectiveness of the campaigns, ignoring how much they cost.

5. Concluding Remarks

In this paper we use the days between consecutive blood donations as a measure for the impact of pro-donation campaigns, that is, the time that has passed for individuals since their last donation. Our data consists of all the registered donors in the population of Navarra during the period January 2008 to April 2013. Several pro-donation campaigns and events were implemented for encouraging blood donations in this region, especially since 2010.

This paper explores if these new campaigns were better on increasing individuals' frequency and regularity of donations as well as the proportion of new donors, than previous campaigns, and also than the periods were no campaigns were active. Our regression analyses show that the days during the first pro-donation campaign after 2010 the days between donations were lower than when no campaign was active. Between this campaign and the last in time no significant effect is observed. It is during the days of life of the last campaign that the days between donations decrease for individuals donating those days. These results suggest that the effect of the campaigns may is not be observed during the campaigns' own life-time. Therefore, the last campaign would be gathering the effect of all the previous campaigns implemented before. In addition, the models show that part of the variation in the outcomes of interest (the days between donations and incremental days between donations) may be due to individuals' characteristics, women and younger individuals being more irregular in donation behavior. Finally we find that the fact of being close to receiving a medal in recognition for the total number of donations increases frequency of donations but also makes individuals donate less regularly once received that recognition. Finally, we observe that the proportion of new donors increased when the new pro-donation campaigns were implemented.

Increasing the time period for analysis is desirable, but for the moment this paper aims to propose a model that serves to estimate the impact of pro-donation campaigns, controlling by individuals characteristics and other pro-donation events and changes

that omitting them from the analysis would result in an inaccurate estimation of the impact of blood donation campaigns.

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Annex

In this annex we provide some additional information concerning the pro-donation campaigns and events that took place during the period 2008-2013, and that were implemented by the Blood Donors' Association

Campaign #0: Bone Marrow pro-donation Campaign 2009. This campaign was the unique campaign implemented between 2008 and end 2009. The date of start was the 4th of April 2009. The slogan of the campaign was *"Your other half is there"*. The objective of this campaign was to encourage individuals to donate bone marrow.

Campaigns #1 and #2: "Y tú, ¿qué eres?" (1st and 2nd phases). The main objective of these campaigns was to increase the number of donations, and also to approach the concept of Blood Donation to the young population.

The campaign was divided into two phases, began with an initial expectation on January 18th 2010. The slogan ("*y tú, qué eres*?") invaded shelters, city buses of Pamplona and Tudela and also televisions. Everyday images such as the town hall, the monument to the charters, and beloved characters for the population, made or answered that question. Anonymous people in the city answered: "*I am shy*", "*I am hard-working", "I'm confused", "I'm a machine", "I am a night owl", "I'm a Pepper", "I am nerd", "I'm guess I'm dreamy"...* The campaign also had an internet presence (www.ytuqueeres.com), today linked to the website of ADONA (www.adona.es).

The second phase of the campaign begins Monday 1st of February 2010. Thanks to the collaboration of the Commonwealth of Pamplona and the local urban transport company. The campaign also featured hangers which provided information posted inside the city buses. This time a total of nine people, popular and related somehow to Navarra, define themselves as *"I am ordered", "I am a fake", I am competitive",* and reveal their blood type *"I'm O-", "I'm A+"*. At the end of this campaign, probably the most important in the history of this association (ADONA), the solution is given and posted everywhere: "*Positive or Negative. We want you as you are*". The objective of this second phase was to attract donors of all the blood types, leaving the message that all the blood types are useful and necessary.

Campaign #3: One day campaign. ADONA in the street. In June 11th 2011, ADONA goes to the street with the objective of informing to the population about blood donation and how to become a donor. The campaign took place in a popular square in the city of Pamplona during the morning (from 10:30 to 14:30 in the afternoon) to provide information and do special activities such as children's workshops and a 3D video with all the matters related to the donation process. The lemma of this campaign was "*Give your face for donation*". Members of the association and collaborators from the media took two pictures of the face of everyone who was willing to participate. The images were used in the future for the advertising campaign *"Yo doy la cara, y tu?"*.

Campaign #4: 2011 Summer campaign: ADONA + Red Cross. In August 2011 ADONA together with the Red Cross, start a summer campaign with the lemma "*This summer, love yourself and think of others*". The aim was to increase the number of donations, which are known to be scarcer during the summer months.

Campaign #5: "Yo doy la cara, ¿y tú?". In September 2011 ADONA started this new campaign. The lemma is different, but the central message is similar, create identity, the identity of being a donor. The objective is to increase the number of donors. The campaign used the pictures that were taken in the one day street campaign (campaign #3 in this paper) in June 2011.

Campaign #6: The regional football team dedicates de month to blood donors. The OSASUNA foundation (the regional soccer team) collaborated with ADONA in June 2011. With the lemma "*We are 12 with you*" they dedicated the month to the blood donors.

Campaign #7: The Extraction Mobile Unit is installed at the University Campus (2 days campaign, previous advertising). The 21st of September 2012 the extraction mobile unit was installed in the University Campus, during two consecutive mornings. The main objective was to attract young donors to blood donation.

The other events and the permanent changes that occur during the same period analyzed, are also described below.

The World Blood Donors' day. Every June 14, the date of birth of Dr. Karl Landsteiner, the discoverer of blood groups and human Rh., the World Blood Donors' day is celebrated. This international event is supported by the World Health Organization, the International Federation of Blood Donor, The Red Cross and Red Crescent which aim to recognize the figure of the blood donor voluntary and altruistic all around the world. Each year a different message is given. For example, the slogan chosen for 2011 in Navarra was "*Paint the world in red in 2011*" and "*More blood, more life*". The objective of this event: to invite people to join blood donation. In 2012 ADONA celebrated this event with two acts. The first took place the day before, Wednesday, June the 13th, at the headquarters of the Parliament of Navarra and consisted of an emotional recognition of Provincial Parliament for the work of all the ADONA delegates.

Tribute and social recognition events to senior blood donors. The 1st of June 2009 in an act for recognition to blood donors, Golden badges were delivered to blood donors who achieved in 2011 a total of 50, 100 and 150 blood donations. The 24th of June 2009 and the 5th of November 2012 blood donors of Navarra celebrated the traditional tribute to blood donors.

A permanent change: The Extraction and donor care times are extended. In December 13th 2010, the Blood Transfusion Center of Navarre, extended the extraction time and care for blood donors. The new hours are Monday to Thursday, uninterrupted, 8:00 h. to 20:00 h. and Friday from 8:00h. to 14:30h. The main objective is to facilitate the donation, making it easier for more people and attract new donors.

General Conclusions

In this thesis we have explored the factors influencing the decision of individuals for becoming or not blood and living organ donors.

The first important result has been the development of a theoretical model that helps to disentangle the psychology behind the specific decision of individuals of becoming or not blood or living organ donors. This model has been developed for two different contexts. The first is the traditional context that considers that blood donation is purely voluntary and altruistic. The second context deals with the case when incentives are offered to individuals who donate. We show how the introduction of incentives could affect to individuals' decision, modifying behavior and introducing the risk of losing the more altruistic individuals at the same time that some individuals could be attracted by the fact that donation is rewarded. As individuals would have different expectations of the benefits and costs from blood and living organ donations, as well as they have different levels of aversion or propensity to incentives, the main result of this model is that there should be an incentive socially efficient, such that the probability of attracting new donors is higher than the probability of losing active donors. However, the problem of impossibility of individualized incentives suggests that empirical research is desirable before introducing incentives. That could be having evidence of the preference on a society towards different incentive mechanisms for example, in order to first have empirical evidence of which incentive would be more efficient (crowding-in new donors) and which incentive would be inefficient (crowd-out active donors).

To this end we have illustrated these important facts with a questionnaire to the university population in Navarra. The questionnaire on attitudes towards blood and living organ donations shows that there are differences between groups of donors (groups of blood and living organ donors are identified and analyzed separately) on the perception of benefits and costs of donations, potential blood donors being more concerned by the costs of blood donations than active donors. This result suggests that experience in blood donation may reduce the expectation of costs. Those individuals who are not completely agree with the perception of other-regarding benefits are more likely to not being willing to donate an organ in life, so other-regarding benefits seem to be a significant factor determining the willingness to donate, at least to our respondents.

To analyze individuals' preferences towards incentives, we included a question where a list of incentives is proposed for individuals to evaluate their agreement/disagreement. The main conclusion is that none of the incentives proposed would be efficient on crowding-in blood donors, while monetary incentives would be very likely to crowd-out active blood donors. In the case of living organ donations we have one incentive that would be likely to crowd-in individuals, that is offering priority in health care to living organ donors. On the contrary, there is a risk of crowding-out associated to offering preference in the waiting lists for a transplant to living organ donors.

The thesis also explores the specific case of France, in which the sample is representative of the general population (ESPS questionnaire 2012) and the first source in general population in France to combine socio-economic and health information with information on blood donations. In this paper we explore the importance of behavioral variables, socio-economic and health characteristics, for the different profiles of blood donors. This article concludes that active donors are generally more altruistic individuals, with higher levels of social capital, and more risk-takers. The assumptions higher levels of altruism and social capital for active donors are confirmed for the population analyzed, reinforcing previous literature results. We also found that active donors are more risk takers than potential donors, confirming our hypothesis. Concerning socio-economic characteristics of the blood donor groups, being a student without having yet obtained the diploma, seems to be a characteristic that also increases the probability of being an active donor compared to those who reported not having education.

The last paper explores the population of blood donors in Navarra. We followed blood donors in the last five and a half years (2008-2013) with the objective of estimating the impact of the new pro-donation campaigns starting in 2010. The paper concludes that during the periods a campaign was active, donations became not only more frequent but regularity also increased. In addition, the proportion of new blood donors was higher during that periods. Finally, increasing the life-time of campaigns we observe that the stronger impact of a campaign is in the first two weeks of life of that campaign, but the campaigns continue being effective three months after its starting date, and also results show that for the new campaigns, the first and the last one being implemented appear to be the more efficient according to our measures considered, indicating this result that when reinforce campaigns are implemented, the hypothesis of

individuals suffering a learning process can be confirmed, the last campaign absorbing therefore the effect of previous campaigns.

ANNEX

THE QUESTIONNAIRE ON ATTITUDES TOWARDS BLOOD AND LIVING ORGAN DONATIONS

BLOQUE I: INFORMACIÓN GENERAL
Marque con una X o escriba la respuesta cuando se le indique

P.1 ¿Es o ha sido usted donante de sangre? (tenga en cuenta que se considera donante regular si en dos años ha donado/solía donar al menos 2 veces cada año)		(1)
Sí, soy donante de sangre regular	1	
Sí, soy donante de sangre pero no regular	2	
Sí, fui donante de sangre pero ya no lo soy	3	
No, no soy donante de sangre ni lo he sido nunca	4	
P.2 ¿Es usted donante de órganos?		(2)
Sí, tengo carné de donante de órganos	1	
No	2	
P.3 En su familia, ¿hay antecedentes de donantes?		(3)
Sí, de sangre	1	
Sí, de órganos	2	
Sí, tanto de sangre como de órganos	3	
No	4	
NS/NC	5	

Gracias por contestar a este primer Bloque. Ahora, pase a contestar al BLOQUE II si es Ud. Donante de sangre regular o, en caso contrario, pase directamente al BLOQUE III

<u>BLOQUE II</u>: Responda a este bloque SÓLO SI ES usted donante de sangre
Marque con una X o escriba la respuesta cuando se le indique

P.4 ¿Por qué decidió ser donante de sangre? Señale **<u>sólo uno</u>** de los siguientes motivos	
Por recibir información de una campaña de donaciones	
Por conocer a alguien que necesitaba una transfusión	
Por tradición familiar	
Porque surgió en conversaciones con mi familia o amigos	
Por ser consciente de la necesidad de donantes para cubrir la demanda de sangre	
Si se le ocurren otros motivos, puede especificarlos a continuación	

P.5 Si es Usted donante regular, ¿Por qué sigue siéndolo?

RAZONES	Muy de Acuerdo	De acuerdo débilmente	En desacuerdo	Muy en desacuerdo	NS/NC
Porque considero que es una obligación cívica	1	2	3	4	5
Porque no se me ocurriría dejarlo	1	2	3	4	5
Porque ser donante de sangre hace que me sienta bien conmigo mismo	1	2	3	4	5
Porque es una oportunidad de devolver a la sociedad parte de lo que recibo de ella	1	2	3	4	5
Porque soy consciente de la necesidad de donantes para cubrir la demanda de sangre	1	2	3	4	5

Si se le ocurren otros motivos, puede especificarlos a continuación

P.6 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre los EFECTOS DE LA DONACIÓN DE SANGRE					
EFECTOS DE LA DONACIÓN DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Donar sangre me supone un coste material y/o intangible	1	2	3	4	5
El mero hecho de donar sangre en sí mismo me produce satisfacción	1	2	3	4	5
Donar sangre me produce satisfacción porque alguien mejorará su vida al recibirla	1	2	3	4	5
La satisfacción de donar sangre es superior a cualquier pérdida de salud o coste como consecuencia de la donación	1	2	3	4	5
La sensación de buena imagen/reputación me produce satisfacción	1	2	3	4	5
Donar sangre puede servir de ejemplo a los que no donan estando en condiciones de hacerlo	1	2	3	4	5
P.7 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre POSIBLES RECOMPENSAS A LOS DONANTES DE SANGRE					
POSIBLES RECOMPENSAS A LOS DONANTES DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Estoy a favor de recompensar a los donantes de sangre con la posibilidad de obtener deducciones fiscales	1	2	3	4	5
Estoy a favor de recompensar a los estudiantes universitarios que donen sangre con créditos de libre elección	1	2	3	4	5
Estoy a favor de recompensar a los donantes de sangre con dinero	1	2	3	4	5
Estoy a favor de reconocer la contribución de los donantes dándoles prioridad en caso de necesidad de una transfusión en el futuro	1	2	3	4	5
Estoy a favor del reconocimiento social de donantes (medallas, publicación de listas de donantes…)	1	2	3	4	5
Estoy a favor de mantener informados a los donantes con estadísticas sobre las donaciones (total recibidas, total útiles, total desechadas…)	1	2	3	4	5
Estoy a favor de enviar a los donantes, tras cada donación, un informe médico completo de su sangre	1	2	3	4	5
Estoy en contra de cualquier tipo de recompensa por donar sangre	1	2	3	4	5

P.8 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre OTROS ASPECTOS RELACIONADOS CON LA DONACIÓN DE SANGRE					
OTROS ASPECTOS RELACIONADOS CON LAS DONACIONES DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
La información sobre las donaciones de sangre es suficiente	1	2	3	4	5
El sistema sanitario público y sus instituciones sanitarias, en el ámbito de las donaciones de sangre, me transmiten confianza	1	2	3	4	5
La información provista por los medios de comunicación es suficiente	1	2	3	4	5
La información provista por los servicios sanitarios es suficiente	1	2	3	4	5
Me gustaría saber a quién va a parar mi sangre una vez donada	1	2	3	4	5
P.9 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre su LOS LUGARES DESTINADOS A LA DONACIÓN DE SANGRE					
SOBRE LOS LUGARES DESTINADOS A LA DONACIÓN DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
La calidad del servicio (personal e instalaciones) es buena	1	2	3	4	5
Los lugares destinados a la donación son adecuados	1	2	3	4	5
P.10 Por último, con respecto a las personas que no donan, ¿Por qué cree que no donan? A continuación, seleccione su grado de acuerdo o desacuerdo con los siguientes motivos					
MOTIVOS	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Por miedo	1	2	3	4	5
Porque no se recibe nada a cambio	1	2	3	4	5
Porque no se lo han planteado	1	2	3	4	5
Por desconfianza en el sistema sanitario	1	2	3	4	5
Por falta de consciencia sobre la necesidad de donantes de sangre	1	2	3	4	5
Porque ya lo hacen otros	1	2	3	4	5
Porque no pueden por motivos de salud	1	2	3	4	5
Si se le ocurren otros motivos, puede indicarlos a continuación					

Gracias por responder a este bloque. Ahora, por favor, pase a responder al BLOQUE III de esta encuesta

BLOQUE III: Responda a este bloque si NO es usted donante de sangre
Marque con una X o escriba la respuesta cuando se le indique

P.11 ¿Ha pensado alguna vez en ser donante de sangre?	
Sí	1
No	2
P.12 ¿Por qué no es usted donante? A continuación, seleccione sólo uno de los siguientes motivos	
Por miedo	
Porque no se recibe ninguna recompensa a cambio	
Porque no me lo he planteado	
Por desconfianza en el sistema sanitario	
Por falta de consciencia sobre las necesidad de donantes de sangre	
Porque ya lo hacen otros	
Porque no puedo por motivos de salud	
Si se le ocurren otros motivos, puede especificarlos a continuación	

P.13 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre los EFECTOS DE DONAR SANGRE

EFECTOS DE DONAR SANGRE	Muy de Acuerdo	De acuerdo débilmente	En desacuerdo	Muy en desacuerdo	NS/NC
Donar sangre supone un coste material y/o intangible	1	2	3	4	5
El mero hecho de donar sangre en sí mismo debe producir satisfacción, aunque no llegue a utilizarse	1	2	3	4	5
Donar sangre provoca satisfacción porque alguien mejorará su vida al recibirla	1	2	3	4	5
La satisfacción de donar sangre debe ser superior a cualquier pérdida de salud o coste como consecuencia de la donación	1	2	3	4	5
La sensación de buena imagen/reputación por donar provoca satisfacción	1	2	3	4	5
Donar sangre puede servir de ejemplo a los que no donan y están en condiciones de hacerlo	1	2	3	4	5

P.14 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre POSIBLES RECOMPENSAS A LOS DONANTES DE SANGRE					
POSIBLES RECOMPENSAS A LOS DONANTES DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Estoy a favor de recompensar a los donantes de sangre con la posibilidad de obtener deducciones fiscales	1	2	3	4	5
Estoy a favor de recompensar a los donantes de sangre con dinero	1	2	3	4	5
Estoy a favor de reconocer la contribución de los donantes dándoles prioridad en caso de necesidad de una transfusión en el futuro	1	2	3	4	5
Estoy a favor del reconocimiento social de donantes (medallas, publicación de listas de donantes…)	1	2	3	4	5
Estoy a favor de que mantener informados a los donantes con estadísticas sobre las donaciones (total recibidas, total útiles, total desechadas…)	1	2	3	4	5
Estoy a favor de enviar a los donantes, tras cada donación, un informe médico completo de su sangre	1	2	3	4	5
Estoy en contra de cualquier tipo de recompensa por donar sangre	1	2	3	4	5
P.15 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre OTROS ASPECTOS RELACIONADOS CON LAS DONACIONES DE SANGRE					
OTROS ASPECTOS RELACIONADOS CON LAS DONACIONES DE SANGRE	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
La información sobre las donaciones de sangre es suficiente	1	2	3	4	5
Estoy informado sobre los requisitos necesarios para poder ser donante de sangre	1	2	3	4	5
El sistema sanitario público y sus instituciones sanitarias, en el ámbito de las donaciones de sangre, me transmiten confianza	1	2	3	4	5
La información provista por los medios de comunicación es suficiente	1	2	3	4	5
La información provista por los servicios sanitarios es suficiente	1	2	3	4	5
Me gustaría saber a quién va a parar mi sangre una vez donada	1	2	3	4	5

P.16 Y con respecto al resto de personas que donan sangre, ¿Por qué cree usted que decidieron ser donantes? A continuación, seleccione su grado de acuerdo o desacuerdo con los siguientes motivos					
MOTIVOS	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Por recibir información de una campaña de donaciones	1	2	3	4	5
Para sentirse una persona mejor	1	2	3	4	5
Por conocer a alguien que necesitaba una transfusión	1	2	3	4	5
Para dar una buena imagen de sí mismos	1	2	3	4	5
Por tradición familiar	1	2	3	4	5
Porque lo consideran una obligación cívica	1	2	3	4	5
Porque sí, simplemente surgió la ocasión	1	2	3	4	5
Por pensar que es la oportunidad de devolver a la sociedad parte de lo que reciben de ella	1	2	3	4	5
Por ser conscientes de la necesidad de donantes para cubrir la demanda de sangre	1	2	3	4	5
Si se le ocurren otros motivos, por favor, especifíquelos a continuación					

Gracias por responder a este bloque. Ahora, pase a responder el BLOQUE IV de esta encuesta

BLOQUE IV: Preguntas sobre las donaciones de órganos en vida
Marque con una X o escriba la pregunta cuando se le indique

P.18 A continuación seleccione su grado de acuerdo o desacuerdo con la siguiente pregunta: En el hipotético caso en que un familiar suyo necesitase un riñón/hígado, ¿estaría usted dispuesto a donar el suyo en vida a esta persona?	
Muy de acuerdo	1
De acuerdo débilmente	2
En desacuerdo	3
Muy en desacuerdo	4
NS/NC	5

P.19 ¿Qué aspectos le preocupan o importan de éste tipo de donaciones?

	Muy de Acuerdo	De acuerdo débilmente	En desacuerdo	Muy en desacuerdo	NS/NC
Me preocupan que tenga efectos negativos sobre mi salud	1	2	3	4	5
Me preocupa que la información sobre este tipo de donaciones sea incompleta	1	2	3	4	5
Es importante tener en cuenta las posibles pérdidas de salud antes de decidir donar un órgano en vida	1	2	3	4	5
Me importa que mi órgano donado no tuviera éxito esperado sobre el receptor	1	2	3	4	5

P.20 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre los EFECTOS ESPERADOS DE LA DONACIÓN DE ÓRGANOS EN VIDA

EFECTOS ESPERADOS DE DONAR UN ÓRGANO EN VIDA	Muy de Acuerdo	De acuerdo débilmente	En desacuerdo	Muy en desacuerdo	NS/NC
El simple hecho de donar un órgano en vida tiene que dar satisfacción	1	2	3	4	5
Donar un órgano en vida es de algún modo contribuir al bienestar de toda la sociedad	1	2	3	4	5
La satisfacción de donar un órgano en vida debe superar todos sus costes	1	2	3	4	5

P.21 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre POSIBLES RECOMPENSAS A LOS DONANTES DE ÓRGANOS EN VIDA					
POSIBLES RECOMPENSAS A LOS DONANTES DE ÓRGANOS EN VIDA	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Estoy a favor de ofrecer algún tipo de reconocimiento a los donantes de órganos en vida	1	2	3	4	5
Estoy a favor de recompensar a los donantes de órganos en vida con dinero	1	2	3	4	5
Estoy a favor de recompensar a los donantes de órganos en vida con deducciones fiscales	1	2	3	4	5
Si donase un órgano en vida, me gustaría que en un futuro, si lo necesito, se me considerase paciente preferente	1	2	3	4	5
Estoy a favor de dar prioridad en asistencia sanitaria a quienes tengan carné de donante de órganos	1	2	3	4	5
P.22 A continuación, seleccione su grado de acuerdo o desacuerdo con las siguientes afirmaciones sobre OTROS ASPECTOS RELACIONADOS CON LAS DONACIONES DE ÓRGANOS EN VIDA					
OTROS ASPECTOS RELACIONADOS CON LAS DONACIONES DE ÓRGANOS EN VIDA	**Muy de Acuerdo**	**De acuerdo débilmente**	**En desacuerdo**	**Muy en desacuerdo**	**NS/NC**
Me considero una persona lo suficientemente sana como para poder ser donante	1	2	3	4	5
El sistema sanitario público y sus médicos, en el ámbito de los trasplantes de órganos, me transmiten confianza	1	2	3	4	5
Conozco el procedimiento a seguir (pruebas médicas de compatibilidad necesarias, etc.)	1	2	3	4	5

Gracias por responder a este bloque. A continuación, pase a responder al último Bloque de esta encuesta

BLOQUE IV: Preguntas Personales

Marque con una X o escriba la pregunta cuando se le indique

P.23 Sexo	
Hombre	1
Mujer	2
P.24 Escriba su edad	
…….. Años	
P.25 Máximo nivel de estudios alcanzado	
Sin estudios	1
Estudios Primarios (EGB o similar)	2
Estudios Secundarios (Formación Profesional, Bachillerato/BUP y COU o similares)	3
Estudios Superiores (Universitarios de Grado Medio y Superior)	4

Muchas gracias por su colaboración al responder a esta encuesta. A continuación, si lo desea, dispone de espacio para hacer comentarios sobre la encuesta.